Course 11599 - Large Scale Structures in Urban Context (1st Part)

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| Register of Methods and Tools | 107 |
Due to the actual complex tasks and challenges there is a need for cooperation and understanding between the disciplines. Thus interdisciplinary teaching is necessary. Up to now different approaches to interdisciplinary teaching have been made, but still there is only little information provided and no practical methodology exist.

The here presented Methodological Guidelines seek to provide some practical methodology on interdisciplinary teaching in the disciplines related to the design and development of the built environment.

The main goal of this document is:

1. to evaluate the existing teaching methods and formats addressing interdisciplinary and intercultural mixed students as well as the new teaching method developed within the framework of the BeInterBaltic project.
2. to develop a convenient tool for teachers helping them to provide students with the skills necessary for addressing the complexity of built environments.

Within the Guidelines the process of methodologically-oriented concept development is presented and analyzed: 1. Semantic → aim, 2. Syntax → purpose, 3. Pragmatic → means/resources. As the interdisciplinary projects require complex solutions, a single method is most often insufficient. For this reason it is important to know how the methods or the strategies and instruments within these methods could be combined with each other.

The following collection of 11 cases originate from the teaching practice of the BeInterBaltic partners: they have been collected and jointly evaluated during the project. In an intensive process all partners agreed on a common language and the methodological structure.

All case studies are based on teaching of courses in a range of programs and scales related to the built environment reaching from architecture and engineering to urban design and planning.

The study concludes with a Register, a directory of didactic tools and methods.

During the development of the Register not only the great variety of methods and tools, but also the different languages between the disciplines became visible. The big challenge was to find a pattern to compare them and get the common essence out of the cases. Thus the first step — evaluation of the existing teaching methods — took more time than expected. Initially a survey of existing methods and format was started — this is still the core of the case studies. But an immense effort was undertaken to structure the case studies in a way that was understandable for any of the participating disciplines.

While working on the guidelines the project partner identified general teaching strategies, not depending on the discipline. Thus the aim of the partner is, to integrate these teaching strategies in the guidelines. As this was not possible under the existing time schedule, the extended document will be finished in the next months. Like the guidelines the whole document will be available on the digital platform of the project.
Architecture is one of the most prominent manifestations of human life and the basic human activity of structuring the living environment. And urbanization as collective endeavor and ongoing process has gained importance as one of the grand challenges for sustainable development of society. Understanding of this complex phenomena of constant construction and reconstruction of our environment involves all fields of knowledge and academic disciplines from humanities, social sciences, natural sciences, formal sciences and applied sciences. Because of the multifacetedness, research into our built environment and teaching into its design and planning are often seen as prototypical example for the need of collaboration between the disciplines. The case for interdisciplinarity, thus, has become a popular idea in academia in recent years.

The notion of interdisciplinarity, however, is only loosely and insufficient defined and can take on a wide range of meanings, from simply encouraging contact and communication among scholars in different fields to far-reaching proposals to dismantle the disciplinary system entirely. In its most general definition, interdisciplinarity is viewed as “any form of dialogue or interaction between two or more disciplines”. Despite being very vague, this definition captures the essential idea that interdisciplinarity is understood as being an attempt of crossing disciplinary boundaries. Such a crossing, however, requires the existence of disciplinary boundaries in the first place. Not surprisingly, in the discourse on interdisciplinarity, the depicturing of traditional academic disciplines as isolated silos, as inwardly focused units closed to the development in other fields, has become commonplace.

This criticism is not new and has its origin in the studies of the organization of academia by the social psychologist Donald Campbell in the late 1960s. In his study he argued that disciplines act like tribes or ethno groups in advancing their group interests, but the principal tendency is to
direct intellectual focus towards the center of the field. Campbell supported his view with a set of diagrams that capture the idea of academic silos effectively, although he never used this term. Very likely, the terminology itself spilled over from the business world into academia in the early 2000s. 05

Campbell’s image of disciplines as isolated, inward-looking entities was challenged almost immediately by Stanley Milgram for whom all interesting problems touch on a variety of disciplines. From his studies he concluded that the typical pattern is not huge chasms separating disciplines but rather intellectual overlap and potential turf wars. 06 A finding that is supported by the work of Muzafer and Carolyn Sherif and their emphasis on overlap between academic fields, rather than the gaps between them, as the main problem. A finding, supported also by latest research into the social structure of academia. 07 According to the Sherifs, the objective of interdisciplinary research is not the solution to particular problems but to check the validity of findings across fields, “each discipline needs the findings from others as a check on the validity of its own generalizations”. 08 From this perspective, interdisciplinarity is not so much about moving beyond the discipline but rather a disciplinary process of checks and balances. Academic disciplines, thus, are not obsolete but the necessary foundation for interdisciplinarity.

Similar to the notion of interdisciplinarity, the concept of a discipline is not evident due to the large variety of existing academic disciplines that makes it difficult to come up with a concise definition. From an etymological point of view the term discipline has its origin in the Latin words discipulus, which means pupil, and disciplina, which means teaching as a noun. 09 The notion of discipline, therefore, is closely linked to a community of teachers and students that interact with each other through teaching and learning. The teaching and learning within the framework of a discipline relates necessarily to that which can be learned where learning in an antique understanding is about the recognition of rules, of the unchanged, of the stable. 10 It follows that an academic discipline can be seen as a form of specific and rigorous training that will turn out scholars who have been ‘disciplined by the discipline’ that is who have been disciplined by a system of orderly conduct and way of thinking. 11 Based on this, the concept of a discipline is not so much defined by the accumulated body of knowledge respectively the scholastic subject area but rather by the immanent perspective onto the world, the mode of inquiry characteristic for the discipline. An academic discipline, thus, can be understood as a social structure consisting of a connected community of scholars that share a mode of inquiry and agree on what constitutes knowledge within the discipline. This need for constant exchange and dialogue infuses dynamism into disciplines. As social entity, they are pushed and pulled by competition over status and resources among scholars within a field, competition among specialty areas within disciplines as well as competition among disciplines. These internal and external forces are propelling scholarship forward and are the reason why disciplines still thrive because they create effective research communities. 12

![Diagram of constituting elements of a discipline and various modes of interdisciplinary interaction.](image)

Academic disciplines should not be viewed as entities focused on the cataloging and archiving of the body of knowledge produced by scholarly communities but rather as dynamic social structures characterized by a specific world view, a mode of understanding defined by a specific type of questions, disciplinary tasks, and specific ways of working in answering these questions, disciplinary methods. It is the interplay of tasks and methods and the produced knowledge as result of this mode of inquiry that defines a discipline. And it is in the interaction of these constituting elements of a discipline that interdisciplinarity is located. Traditionally, interdisciplinarity has been closely linked to the transfer of knowledge from one discipline to another one in the attempt to generate understanding between these disciplines and activate a capacity for dialogue between them. The decoupling of the disciplinary knowledge from the disciplinary mode of inquiry, however, motivates a behavioristic form of teaching with
students as passive receiver, as consumer of expert knowledge presented by the teacher. Such knowledge often is not integrated very well into the student’s mind and does not challenge existing cognitive schemata. Because of this, interdisciplinary knowledge transfer is especially effective in conveying basic rules and guidelines from one discipline into another one.

However, knowledge transfer does not provide “a check on the validity of [ones] own generalizations”, the objective of interdisciplinary according to Muzafer and Carolyn Sherif. For such reviewing of schemata, a deeper understanding of coherencies and the activation of metacognition is required. This challenging of the disciplinary understanding is the aim in the exploration of modes of inquiry provided by other disciplines. The transfer of methods or tasks from one discipline into another one fosters a deeper-reaching investigation into one’s own disciplinary assumptions and relationships that is into the existing perspective of the world and its validity.

This study, therefore, is concerned primarily with didactic strategies for the transfer of methods and tasks as part of an interdisciplinary teaching. Five strategies have proven to be of importance for such type of teaching, namely experimental learning, limitation, increasing complexity, iteration and disruptive expansion. They will be discussed in detail in the extended edition of the study (see Foreword). In the next chapter a number of case studies demonstrates the use of these strategies in practice. All case studies are based on teaching of courses in a range of programs and scales related to the built environment reaching from architecture and engineering to urban design and planning. The study concludes with a “Register”, a directory of didactic tools and methods.
This document contains 11 case studies from the teaching experience of the BeInterBaltic project partners. All case studies are based on teaching of courses in a range of programs and scales related to the built environment reaching from architecture and engineering to urban design and planning.

In order to be able to compare the content of the cases a common framework was created which was also used to facilitate the process of analysis and evaluation of the collected material.

**Case Framework**

1. **Strategy and Content**
   - Content of the Case
   - Teaching Strategy and Learning Output

2. **Boundary Conditions**
   - Format of the Case
   - Group of Participants

3. **Interdisciplinary Character of the Case**

4. **Methods and Tools**
   - Role of Teacher(s)
   - Methods
   - Tools

5. **Process and Implementation**
   - Chronological Development
   - Development of Contents (Case Tree)

6. **Reflection**
   - Reflection on the Teaching Strategy|Methods|Tools
   - Reflection on the Quality of the Outcome
   - Reflection on the Learning Output
   - Reflection on the Interdisciplinarity
   - Comment on the Case
   - Comment on the Communicative Structure
Range of the Thematic Scope of the Cases

from structural design through architecture to urban planning.

01 Introduction into conceptual design based on formal methods of exploration, between architectural ideas and structural principles = design research into abstract formation processes = development of a spatial concept into proto-architectural proposal; geometry functions as a mediator between the disciplines of architecture and structural engineering.

02 Introduction to structural design for architecture students in order to be able to read structures in a qualitative way, to be able to design of structural systems, to be able to perform explorative design experiments, to establish a language that supports a dialogue with structural engineers.

03 Speed-up teaching about “structures and materials”, the course is about understanding and experiencing structural behavior by working hands-on with physical models, without any previous experience, knowledge.

04 A large design project course where the main strategy is to set a project in a realistic framework through a collaboration with a municipality. Focus on specific design method, and the transition from one design phase to another: a transition from a completely blank sheet where gradually more and more disciplines are added: traffic, climate adaptation, solar conditions on the site, history, a new programming and storytelling for the site, conceptual structural design, geometry. The new programming and story for the site should be made manifest in a structure.

05 Development of a complete prototype proposal from a research phase to the construction and testing on site; designing of customized tools, called “architectural devices” in order to research and comprehend the magnitude and quality of hyper-specific site conditions and inform design.

06 Exploration of the topic of multi-layered and multi-sensory reception of public spaces and the integration of the results in the design concepts – alternative interventions in public space; transformation of public space in the context of interdisciplinary design

07 Activation of a local community by raising awareness about specific problems and qualities of space in a specific urban context and about the concerns related to these qualities and problems, responsibility towards the local environment; creation of a platform and methods of communication, to initiate exchange and transfer of information, knowledge an ideas among different involved actors and stakeholders – students are only one part of the participants.

08 Preparation of a civic concept for the development of historically important public space in the form of a participatory transdisciplinary workshop. A bottom-up initiative supported by the local city authority which was organized using the Design Thinking strategy – students are only one part of the participants.

09 Development of a Neighbourhood guideline within a transdisciplinary participatory workshop. No teaching involved. Application of interdisciplinary learning outside the academia in the field – learning process for stakeholders.

10 Research as an experience of critical investigation of the spatial qualities of the city; introduction of urban sociological perspectives, research methodologies and methods applied at identification and evaluation of urban spatial qualities. Incorporation of students’ disciplinary skills into proposals of design ideas elaborated on considerations drawn on sociological inquiry.

11 New teaching module “Intersections in the built environment” – speed-up development of design proposals in interdisciplinary and inerculturally mixed groups.

Spectrum of the Boundary Conditions

Format of the cases: from regularly offered semester courses, block and elective courses to design studios and interdisciplinary workshops

Duration: workshops lasting between 1 day and 2 weeks, semester courses lasting 2 to 3 months; one workshop with a duration of 5 months

Number of participants: from small groups of 12-15 participants through middle-sized groups of 20-25 to larger groups of 50-60 participants; the biggest two groups consist of 80 and 180 participants.

Higher education level: Bachelor level — 3 cases; Master level — 4 cases; mixed levels — 3 cases; 1 case — no students

Interdisciplinarity in the cases:

- Disciplinary team — interdisciplinary tasks / knowledge: 01, 02, 03, 04, 05, 09
- Interdisciplinary team — discipline tasks: 06, 07, 08, 10
- Interdisciplinary team — interdisciplinary tasks: 11

Role of Teacher(s):

- Teachers as an expert (consultant): 01, 02, 04, 05, 06, 09, 11
- Teacher as a moderator: 01, 03, 04, 05, 06, 08, 11
- No teaching “everybody learns from each other” 07, 10

Modes of interdisciplinary interaction (Knowledge, method, task transfer)

01 Knowledge and method transfer — structural principles in architecture

02 Knowledge and method transfer — structural methods in architecture

03 Knowledge and method transfer — structural methods in architecture
Knowledge, method and task transfer — a back cloth for both artistic exercises and engineering analysis. Combined, the exercises or teaching elements outline a full interdisciplinary design process including artistic, architectural, urbanistic, engineering and mathematical methods. Emphasis is on design.

Knowledge and method transfer — climatic design, sustainable design, simulation modeling, data acquisition, material understanding, structural behavior, biology, anthropology in architectural "device" design.

Knowledge, method and task transfer — interplay of methods in the exploration and examination of sensual qualities of urban space and its potentials. Experimental exploration of sensual qualities of space within the disciplines of architecture and engineering.

Knowledge, method and task transfer — creating common language in an interdisciplinary context.

Knowledge, method and task transfer — using the strategy of Design Thinking in an interdisciplinary context.

Knowledge and method transfer — sociological methods and theories in architectural design.

Knowledge and method transfer — transdisciplinary participatory approach.

Knowledge, method and task transfer — a test field for the elaboration of interdisciplinary teaching material for the education of disciplines related to the built environment, such as architects, structural engineers, urban planners, urban designers, artists and others.
1 Strategy and Content

Content of the case
The design studio is an introduction into conceptual design based on formal methods of exploration. It aims at the coherent development of a spatial concept into a proto-architectural proposal. No program, no site, nor user is given. Rather the design process develops out of an investigation of simple geometric relationships and the inherent potential for transformations of the dynamic of space. The studio can be seen as design-research into abstract formation processes at the threshold between quantifiable and non-quantifiable design parameter.

Teaching Strategy and Learning Output
The teaching is aiming at an individual exploration of the spatial potential of geometric operations and the development of an awareness of architectural form as a carrier of information. Like in a lab-situation the course explores the problem in isolation (no program, no site, no user etc; only focus on formation process) and in a step-by-step manner of increasing complexity (from family of lines to spatial complex, from simple form to material system). The course is not aiming at a complete architectural proposal but rather at a schematic design level. It explores mental formation processes and their proto-architectural manifestation that is how conceptual ideas can be developed and expressed with the means of architecture like material form and organization, or spatial flow and dynamics (Figure 1). This is the primary teaching output.

Figure 1: an urban park and a cliff-diving platform as proto-architectural proposal (Formal Design Studio, Aalto University, fall, 2015, student: Hanna Jahkonen)

2 Boundary Conditions

Format of the case
Design studio, master level, 12 weeks, 10 credits (= 270 hours)

Group of participants
12-15 M.Arch. students; no specific set of skills is required but good modelling skills are beneficial.

3 Interdisciplinary Character of the Case
The design exploration within the studio is based on an interplay of methods of formal abstraction and physical concretization that is on a fluid interchange between architectural ideas and structural principles. In this context, geometry functions as mediator between the disciplines of architecture and structural engineering. The studio aims at a merging of these disciplines by the activation of structural ideas and principles as architectural means of expression.

4 Methods and Tools

Role of the Teacher(s)
The studio course is predominantly student centered with the teacher as consultant and moderator. Only during few input lectures the role of the teacher switches to a more teacher-centered teaching.

Methods
- Input lectures: short lectures to motivate the next exercise, contextualize it with respect to the goals of the course and relate it to the general discourse within contemporary architecture.
- Group work: all exercises are done as group of two-three students to foster discussion and continues feedback in the design process.
- Required reading: a collection of theoretical texts is provided (around 250 pages), grouped in themes, that students have to work through in parallel to the studio work. This should help to confront their work with the ongoing discourse in architecture and bring an external perspective to the design process.
- Discussion rounds: on two occasions the design studio is put on hold and replaced by an open discussion round that uses the required reading as background for a reflection on architecture as a discipline and the current state of art.
- Interim presentation: summary of the first phase of the design process on one A1 board. Communication of the basic ideas and findings only through precise drawings and diagrams. Verbal presentation of the project by another group. This way, weaknesses of the visual communication get apparent very fast and a productive discussion can happen that is driven by the students themselves.
- Final presentation: several groups with similar design approach present in sequence (every group max 5 min.) the outcome of their design process (concept development...
and translation into proto-architecture) using a pre-structured slide show (number and topic of each slide defined) and one model. Through comparison the project are reviewed in an open discussion between the jury and the students and contextualized within the contemporary discourse within architecture. All reviewers are externals with an international background.

**Documentation** the studio does not end with the final presentation but rather with a final documentation that functions as reflection of the process. Students are required to write a 2-3 pages long article-like essay on the design thinking that governed the design process. Comments and remarks by the jury as well as required readings and discussions have to be considered and reflected and form the context to which the essay has to refer. The aim is the linking of the designing with the discourse within the discipline.

**Tools**

**Parametric Variation** systematic exploration of effects of changes of two to three parameters within a simple geometric configuration of primary forms like four parallel lines or three circles. The evaluation of the configuration is based on the changes in the spatial dynamic of the configuration and the linking of architectural effects to specific parameter settings. (exercise in 2D) (Figure 2)

**Geometric Transformation** extension of the Parametric Variation exercise from 2D into 3D by systematic variation of the spatial configuration in the third dimension. In addition, introduction of simple geometric transformations of the primary form that enhance or modulate the observed spatial dynamic and allow a fine-tuning of architectural effects.

**Graphic Statics** linking of spatial configuration with questions of structural stability by means of construction of the inner force flow. Graphic Statics functions as a formal language based on the interplay of tension and compression. It is essentially parametric and enables a direct non-typological correlation of structural and spatial concepts based on the activation of first principles. As such it is the right tool for the interdisciplinary interaction of architecture and structural engineering at an early design phase.

**3D-Printing** in addition to simple paper-based conceptual models, 3-D printing is used for the visualization of spatial concepts from the beginning of the design process. This way a haptic dimension can be integrated into the conceptual design phase that also helps to balance spatial ideas with structural requirements by pointing very early on to weaknesses in the concept.

## 5 Process and Implementation

**Chronological Development**

12 weeks long studio organized in three blocks: 5 / 5 / 2 with focus on development of the spatial configuration (Discover), the integration of structural concepts (Explore), and the reflection on the design process (Deliver). In addition to the classical studio teaching a parallel stream of lectures and reading & discussions is organized to add a reflective level to the design process. Thus, theory and practice is constantly mixed together into a dialogue.

**Development of contents | Outputs**

See Case Tree in: Page 25.

## 6 Reflection

**Reflection on the Teaching Strategy | Methods | Tools**

Most of the used teaching methods and tools are well-known. But especially the tools are in a non-conventional way that does not emphasize the technical aspects of the tools (like it is done in general) but rather the impact on the spatial dynamic was at the forefront. This means most of the tools were taken out of the conventional context and re-contextualized in a way to link technical aspects with a more phenomenological understanding of architecture.

The same can be said about the methods of teaching. A design studio typically focusses on the design process. In the presented studio teaching a level of theoretical reflection is integrated as important part of the design process and with it an emphasize on thinking and theoretical reflection as important aspect of the design process.

**Reflection on the Quality of the Outcome**

The quality of the design outcome was good. A large variety of projects were developed that all have in common a creative use of structural principles and their articulation as architectural element.

**Reflection on the Learning Output**

The final documentation was on a high level showing a clear understating of major topics of the course and starting knowledge of the theoretical discourse within the discipline. Clearly, the amount of material covered within the lectures and the required reading limited the intensity within the design process itself. Because of this the outcome cannot be compared with a traditional design studio but rather represents a hybrid course between theory course and design studio. The work load is high and the teaching strategy requires many hours of individual discussion of the teacher.
Reflection on the Interdisciplinarity
The goal of integrating structural questions into the architectural design process already on a conceptual level could be achieved. All projects clearly developed a structural concept that, at the same time, was an essential part of the spatial articulation. The non-typological teaching of structural knowledge allowed students a playful approach to structures and the production of prototypes at an early stage produced interest on the student side similar to problem-based learning approaches.

Comment on the Case
The described teaching strategy is only applicable to students with a good background in architecture and basic knowledge in structural design. Hence, only for an advanced Master level. Students with an engineering background might not be able to benefit from this course due to the required knowledge in architecture.

Comment on the Communicative Structure
The communicative structure is clearly organized and phased. The challenge of the course is the quality of the required reading and the guidance of the discussions and the presentations that is the merging of the practical and theoretical strand of the course.
Structural Design for 1st Year Architecture Students

KARL-GUNNAR OLSSON
Chalmers University of Technology, Sweden
Department of Architecture

1 Strategy and Content

Content of the case
The Structural Design course for the first-year architecture students takes part during their second semester. The previous first semester is dominated by architectural history, exercises and workshops for spatial explorations and a smaller architectural design project. The first eight weeks in the second semester is one of two spaces in the architecture program where there is no parallel architectural design project ongoing. The course is taught in parallel with three other courses/moments: materials, building technology and sustainable building. The Structural Design course has 30% of the time over 8 weeks. The Structural Design course is divided into three approaches of entering the subject:

- **The building as a logic (topological) load carrying system** — sorting out different readings of a load carrying structure. Logic system for gravity, logic system for horizontal loads of different sources, capacity for handling internal or external driven movements.

- **Bodies, structures and forces** — basic concepts from mechanics are elaborated from both a scientific and artistic and explorative point of departure.

- **Architectural structures** — classical types of “architectural structures”: cable and arch, truss, beam and frame, membrane, and column. Elaborating with their role/task in a structural logic. Alternatives of design for three main structural tasks (axial transformation of forces, spanning a space, and cantilevering) especially the relation between structural form and action, and structural efficiency. Creating a repertoire of structures in built examples.

In all three approaches references like built examples, other artifacts, and the own body, is continuously current to anchor abstractions (the logic, the concepts and the types) in the real world and to problematize the use of models/abstractions. However, there is a focus on a conceptual language and its belonging representations, with the overall aim to support a conceptual dialogue between architects and engineers, and in this course taking the point of departure in the questions of an architect in an early design stage.

Learning Outcome
The overall aim for the course is to support the students:

- To reach a certain level of systematic abstraction that gives them ability for a qualitative reading of structures as well as skills and tools for explorative design of structural systems.
- To develop experience and self confidence to perform own explorative design experiments of space and form in interplay with fundamental mechanisms of structural behavior and a structural/material efficiency.
- To establish a language that supports a dialogue with structural engineers in early design stages regarding alternative structural design for certain architectural aims and wishes.

In the course plan these aims are expressed as the following learning outcomes possible to examine:

- Demonstrate understanding of the fundamental concepts and relationships of structural design.
- Demonstrate understanding of how the components of a load-bearing structure are logically organized to distribute vertical and horizontal loads (gravity and wind).
- Diagram the load reactions and load distribution of a load carrying structure, and apply them as design elements in a design process.
- Analyze structural designs in terms of stability, rigidity, and strength.
- Demonstrate a basic repertoire of structural archetypes.
- Show examples of work with sketches and models that explore the interplay between load paths and structural design.

Teaching Strategy
The teaching strategy, i.e. the composition of the course structure and the supporting activities, has several and parallel applied components:

- The use of references (from built examples, to art and play tools) to: Anchor the value of reading structures through abstract mechanisms and structural logic. Build a repertoire of examples where the organization of the structure is an important part of the architectural values.
- The use of different and parallel representations (of bodies, structures, dimensions, forces organized to patterns, etc. — from scientific representations with different precision to metaphors and narratives) to: Read and understand structural action behind different scientific representations. Jump between parallel rooms of representations as tools in an artistic approach. Be aware of the strengths and weaknesses of different representations.
- The use of parallel logical schemes and typologies (structural order, structural system due to Heino Engel, structural tasks) to: Read and understand structural action on different
scale levels. Discover general pattern being there independent of used schemes, typologies and representations.

- The formulation of artistic and explorative design tasks based on certain structural rules, to: Discover the diversity of design solutions relying on one and the only structural mechanism/principle. Discover how gravity, density, location of supports in equilibrium, alternative force patterns, etc. can be used as means for architectural expression.
- The explorations with physical models to: Experience structural phenomena such as bending, tension, compression and buckling, and different failure modes.
- The repetitive and iterative process where terms and concepts appear in a successively more complex context, to: Simplify in order to extract the essence of, for example, a structural concept. Then anchoring the concept by applying it in a more complex context.

From this strategy a set of methods and tools have emerged to support the strategy. Two of these tools are the computer programs pointSketch and ForcePAD.

2 Boundary Conditions

Format of the case
B. Sc. Program of Architecture, First year, Spring semester, 30% of full time for 8 weeks, 4.5 credits (≈120 hours).

Group of participants
In total 80 students from first year, seminar groups of 8 persons, textbook groups of 2 persons (but some prefer to work on their own). The students have varied high-school backgrounds, ranging from artistic to humanistic and natural science programs.

3 Interdisciplinary Character of the Case

Both architects and structural engineers deal with load-carrying structures. Architects, with physical and digital geometry models in different stages of the design process and in order to explore different values of architecture such as space and space organization, light, appearance, etc. Engineers are often involved quite late in a design process, and then using mathematical models to simulate structural behavior, size structural components, and estimate safety. Each of these approaches to structures has its own discourse. The aim of the course is to establish an expanded and common discourse with languages, representations and tools that promotes and improves the interdisciplinary and collaborative architectural and structural design process. Knowledge of key concepts, of agreed simplifications and definitions, along with insights about own and others’ differing interpretations, can form a basis of a common language. Understanding of the underlying phenomena and mechanisms of structures and being familiar with some fundamental force and movement patterns and how they can be manipulated, can create a foundation for exercises where structural efficiency interplays with expression, where composition of structures for strength and stability interplays with spatial qualities. To prepare for future collaboration between architects and engineers, parts of the course concept also are implemented in the traditional engineering courses at Chalmers.

4 Methods and Tools

Role of the teacher(s)
The teachers in the course consist of a lecturer and examiner, and 10-12 supervisors. The role of the lecturer and examiner is to lecture for the students and for the supervisors (two separate lectures), to collect and respond on common questions from the students and the supervisors after the weekly seminars, to lead and secure the implementation of the course strategy, and to organize and follow up the continuous examination. The role of the supervisors is to guide the seminars, to give feedback on experienced difficulties in the exercises, and to report the activity in the group.

Methods
Each of the above described components of the teaching strategy is connected to specific methods and tools. The last strategy — the repetitive and iterative process — is the overall one and will be emphasized here and described more in detail. It consists of four expanding cycles: A 3 to 4 hour long LECTURE, one day of EXPLORATIVE WORK, a 2-hour GROUP SEMINA with the form of a REFLECTED CRITIQUE, and finally, after 7 weeks of collecting material, ORGANIZING OF THE MATERIAL TO A COHERENT STORY (SYNTHESIS) that picks up and integrates the elements in the course.

The initial LECTURE consists of a theoretical framework with terms, concepts, systematics, and modes of action. Parallel representations are used, and a lot of built examples are introduced to bridge between the real world and the representations. The first cycle happens when an EXERCISE, integrated as a short break in the lecturing, takes a step back, ask questions to the theory, and suggest exercises to explore it. This happens 5-8 times during the 3-4 hours lecture.

The morning lecture is immediately followed by an afternoon one and on the following morning the explorative work with the exercises takes place. The students work two by two but are allowed to exchange thoughts and ideas in the studio (normally 16 students). An experience, recurring in course evaluations, is that even if the question felt to be understood during the lecture, it is completely inconceivable when facing it in the studio. Some try to dig on the internet or in literature (not recommended) and some dig in own experience and by doing the proposed sketches, computer and physical experiments. There is a text book for the course and recommended literature, but we ask the students to wait and not read until quite late in the course when they have enough terms and concepts to more thoroughly grasp the text.

A SEMINAR follows in the afternoon of the second day. In groups of 8 students, supervised by mainly 3rd year students from the Architecture and Engineering program, the physical outcome of the exercises is shown and presented. The supervisors are not
allowed to give answers, but to guide the discussion to secure that the group have understood the exercises and that the output shows it. If students at the end of a seminar have not convinced the supervisor that they have reached a certain level of understanding, they should do it before the next seminar. A few times this does not happen, and then the course examiner must follow it up. The supervisors also take short notes which support the examination at the end of the course.

After seven seminars (eight when there also is a literature seminar) the students have collected quite a huge amount of own produced material — a kind of portfolio. The last cycle, together with reading the recommended textbook, aims to repeat and bring things together. The exercise in this last cycle is about to bring the collected material on the table and reorganize it to a coherent story — the student’s self-created textbook in structural design. This cycle aims to link the different part of the course together to an understandable whole.

The third strategy - the use of parallel logical schemes and typologies — and its belonging methods is also worth to mention. It consists of four parallel readings of a load carrying structure:

First an external framework for a reading of structures — a topological logic — is introduced. By built examples, read as structural compositions, a topology and structural logic is discussed in terms of vertical load carrying elements, primary beams, secondary beams, stabilizing walls etc. A set of simple general rules are given. As conventions for representations are lacking the students may create their own representations.

Second a logic for stable structures is introduced, including the concepts of outer and inner mechanisms, statically determinant and indeterminant structures. The computer tool pointSketch, with real-time feedback on each design step, is frequently used here. In the end, the first and second logic are compared and shown to be parallel and possible readings for one and the same built structure.

The third reading is a more conventional among architects – the typological reading. Here we use the typology of Heino Engel in his book Structural Systems. It consists of form-active, vector-active, section-active and surface-active structures. This typology has in its systematics a capacity to explain structural efficiency, based on the character of the local equilibrium where the external load meet the structure.

The last reading, implicit mentioned before but formally introduced the last seminar week, is the reading of force patterns connected to structural tasks. Three such tasks with their connecting force patterns are elaborated with — to lift, to span and to cantilever. A bridge building competition, with the task to span a space of 90 cm with a maximum of 130 g material weight, gives the opportunity to show how complete different structural design only are variations of the same general force pattern.

Tools

Two computer tools have been developed in close connection to the course idea — pointSketch och ForcePAD. Both the programs can act as sketching board for ideas to be evaluated and developed further, as well as providing a common language for the engineers and architects alike who are involved. The programs are designed to allow the following overall goals to be achived:

- Providing knowledge of the limited set of actions and of basic variables that governs the structural behaviour involved.
- Using sketching as a way of working in the exploration of form.
- Enabling form (cause) and action to be shown simultaneously.
- Obtaining pictures showing such global qualities such as stress and deformation patterns that can be normed to allow the results obtained for different designs to be compared.
- Providing the possibility of working at different levels of precision, from qualitative to quantitative levels.
5 Process and Implementation

Chronological development

Week 1 – The Building as a Load Carrying System

The course is introduced through a historic expose over architectural structures sorted by material — stone, brick, timber, iron, concrete — and where the expression of the building is related to fundamental material properties: load bearing capacity in compression and in tension. Then a topologic systematic with a language for reading and explaining an arbitrary building as a load carrying system is introduced. Three parallel readings of the load carrying system is trained — for gravity (that normally organizes the shape of a building), for horizontal loads of different sources (“stabilization” of a building), and the system robustness for handling internal and/or external driven movements. The concept of “representation” is discussed and symbols for primary beams, secondary beams, etc. is defined. These 1-dimensional representations will in the following weeks be elaborated with, and given an expanded 3-dimensional meaning, but always possible to take back the topological systematic for a more fundamental exploration of alternative design solutions.

Week 2 – Bodies and Structures

The second week explores concepts and terms related to the “rigid body” and the “flexible structure.” Two main entrances are: sketching and physical model building through the “fix points in space” (2D and 3D) exercise, and exploring the fundamentals of rigid bodies and structures through the computer tool pointSketch. With the four fundamental elements of structures: node, force interaction (bar), support, and load, most of the investigated structural elements and structures in the course can be built and explored in pointSketch. The program allows the student in real time to explore the relation between form, movements (mechanism), force field and deformations. These investigations are primary qualitative, but by open a higher level of the program, also numbers can be added. After the second week the students have thoroughly worked with the concepts: dimension, rigid body, flexible structure, representation, mechanism, inner and outer stability, and topology.

Week 3 and 4 – Forces

During week 3 and 4 the concepts of force and equilibrium is introduced. Starting with the fundamentals of gravity and electromagnetic interaction, we then step by step...
introduces successively more complex representations: normal stress, shear stress and friction, normal and shear force, force components and resultant force, and finally moment. Then equilibrium for particles and rigid bodies are introduced and explored. The focus is on conceptual understanding of force and equilibrium, and working in different dimensions.

Week 5, 6 and 7 – Structural Systems

Relying on an understanding of load-bearing structures as logic systems, these systems now can further be explored by introducing structural elements (modes of actions) like cable (tension), bar (tension and compression), beam (bending), and structural types like arches, trusses, frames, and membranes. The systematics from Heino Engels Structural Systems is used.

Week 7 – Structural tasks and the Bridge competition

Week 7 have the heading membranes and columns. Beside introducing two structural elements we also use them for a wider purpose. The membrane theory gives a possibility, and ForcePAD a tool, to more in depth explore and challenge the force patterns of three structural tasks — to lift, to span and to cantilever. And through exploring the different modes of Euler buckling of columns, we can expand these patterns to a reading of all compression patterns (blue color) in our pointSketch and forcePAD diagrams. The week completes with a bridge design competition where the aim is to create awareness on the common force pattern behind each of the different design proposals, and to read the buckling along “the blue lines”.

Week 8 – Textbook and Examination

The last week consists of writing the textbook, and some years a literature seminar. The examination consists of two parts, fulfilled seminars with a documented activity, and a proved own composed textbook.

Development of the contents | Outputs
See Case Tree in: Page 37.
6 Reflection

The course is followed up in three architectural projects during the bachelor. Here we support the students to take command of their own structural design process. In the last of these projects the students work with experienced engineers as supervisors, and are trained to interact creatively with engineers and to explain and argue for their own structural concepts.

The course has over many years received a very high score in the Chalmers course evaluation system. Year 2018: 4.45 out of 5.

05  Karl-Gunnar Olsson, Pierre Olsson, Jonas Lindemann & Göran Sandberg. “Form Finding Based on Virtual Load Paths and the Concept of Stiffness.” Toward the future looking to the past, International Association for Shell and Spatial Structures, IASS Symposium 2007, Venice.
1 Strategy and Content

Content of the case
This case outlines the teaching at the beginning of the first semester at the Royal Danish Academy of Fine Arts School of Architecture (KADK) in Copenhagen. The “6 week-blocks” — a block of teaching bringing ALL undergraduate students from a particular year together has been introduced with the aim of bringing all undergraduates of a particular year up-to-speed with core subjects, but also specific skills both technical, drawing as well as design skills. The blocks encompass different forms of teaching organized around a specific theme.

The case describes the teaching and learning process during the first year six-week block, marked in green, where over two weeks the students were taught about structures and materials. The overreaching context-theme of that particular block was “dwelling” and 180 students took part.

Teaching Strategy and learning output

BA Structure at KADK

The teaching strategy was to experience structural behavior by working hands-on with physical models before getting an explanation about how and why structures behave when loaded in different ways. The learning output was to gain basic understanding about structures in an architectural context. It was therefore important to teach in an experiential way. Experiencing buckling, bending, stability... before the lectures was essential as the students relate to the experience they have had, are more interested and understand the lectures better and most importantly: it is the experience they remember for a long time. Perhaps it is fair to state that this teaching strategy works exceptionally well in environments with students who often lack basic technical and mathematical skills, yet the course is not long enough to bring the students up to speed with basic requirements for a technical course. It is also a way to make the teaching fun and interesting, which is important in an architectural environment where it would be seen as boring and hard to follow if the same content was delivered in a more classical way. This is not to say that conventional way of teaching is not good, it is just that it would be very difficult, if not impossible, to offer a meaningful course on the same subject in the time available and having in mind the non-existent mathematical skills of the student group. The main aim of the teaching was to offer an understanding on structural principles, concepts and their implication on architecture. The latter is very important to bear in mind.

2 Boundary Conditions

Format and content of the case
The two weeks were a combination of workshops — mainly hands on, lectures, discussions, reading, documenting and reflecting. We worked with physical models in small and large — full scale. The two weeks were different in format and content. However, the overreaching principle was that all the workshops were designed in such a way, so that the students could experience structural behavior. The programme/s were the following:

Week 1

**Day 1 / Workshop 1**
- **Build high-reaching the sky**
  - Without any previous experience/knowledge the 180 students of first year were asked to build towers as high as possible. The aim was to experience buckling. The students had to use very slender sticks and towers of 5.5 m were constructed. Everyone struggled with the slender sticks that were bending sideways and had very small buckling capacity. It was a powerful experience.

**Day 2 / Workshop 2**
- **Spanning-minimal bridges**
  - Without any previous experience/knowledge the 180 students of first year were asked to build minimal bridges able to span a distance of 50 cm. The aim was to experience bending. The students used A4 sheets of paper and glue. The model bridges were load-tested and a load/weight ratio was calculated. The paper bridge weighing only 21 grams was the winner and this bridge could carry 5 kg of weight: it could carry nearly 240 times its own weight!
The brief was to design and build a city in 1:1. The site was on 4 islands and each student was asked to build a stable structure that would in real size represent a 5x5x5 building. The aim was to experience stability. They used the sticks of the first models that were dismantled and reused.

Without any previous experience/knowledge the 180 students of first year were asked to build a stable structure that would in real size represent a 5x5x5 building. The aim was to experience stability. They used the sticks of the first models that were dismantled and reused.

A double lecture about load-bearing structures, static systems and materials was given. The lecture emphasized and explained the Workshop aspects that the students already had experienced (Buckling, stress-types and bending, stability, structural systems…). As the students had already experienced some of these forms of structural behavior — they could more easily understand and memorize these concepts.

Selected texts were given and the students in groups of 5, had to come up with 5 questions. Then in the last hour in plenum 180 students discussed together. One group was sat in the front of the auditorium and they posed their question. Students from the audience responded and gave their views. The discussion was related to structures in an architectural context, materials, tectonic principles, aesthetics, collaboration, representation/modeling of behavior etc. The teacher was a moderator only.

In this workshop students (individually) were asked to look for a structural example in walking distance to the KADK School of Architecture. The example had to be structurally interesting, they had to try understand how the structure work, be able to describe the load-bearing structure, the materials used and the context. The students were allowed to use sketches, photos, computer images, physical models that were then exhibited. In addition, each student was asked to do a 2 min. presentation to a panel of teachers and the other 180 students.

The two weeks of teaching presented in this case were mainly student-centered. It was very important that the students experience structural behavior, but also to be able to organize themselves as a group with different tasks for different members in the student groups. The teacher’s role was more of a moderator in the activities. The teacher did not offer solutions, but rather posed questions. An exception to this was the lecture about structural behavior, which was given after the students had done the small workshops about experiencing buckling, bending, stability.

The two weeks were part of a six-week block of first year teaching. The course was carried out in the Autumn semester and the students had only been for two weeks at university at the time. They had very little prior knowledge in anything connected to structures and materials and very few of them had any mathematical background.

3 Interdisciplinary Character of The Case

The course is with one type of students — all are enrolled on an Architecture undergraduate programme. The interdisciplinarity is in the sense that the teaching is in another discipline — structural design. Also, the two disciplines (architecture and engineering) are taught together and at the same time. Furthermore, the students have to deal simultaneously with two, often conflicting sets of values: purely architectural - as context, proportions, aesthetics, etc. as well as structural requirements - as safety, structural concept, size/proportions of structural members, connection detailing, etc. This is particularly true for the second week when they are building in full-scale.

4 Methods and Tools

Role of teacher

The two weeks of teaching presented in this case were mainly student-centered. It was very important that the students experience structural behavior, but also to be able to organize themselves as a group with different tasks for different members in the student groups. The teacher’s role was more of a moderator in the activities. The teacher did not offer solutions, but rather posed questions. An exception to this was the lecture about structural behavior, which was given after the students had done the small workshops about experiencing buckling, bending, stability.
Methods and Tools

The choice of teaching methods that were applied, were teaching with involvement i.e. hands on, discussion, exhibition, etc. all of which were as visual as possible. This was very appropriate and suited to the audience — first year architecture students most of whom had no mathematical background. Physical modeling techniques in small and large scale, power-point presentation, debate, reflection, film-making, recording/presentation with drawings, models, sketches, were used during the teaching. The experiential approach worked exceptionally well.

Within this case the following methods and tools were used. They are defined, although not in the order used, in how they should be understood within the context of this particular case study:

LECTURES: a presentation of a topic by one person (expert) to a group.

INPUT LECTURE: short lecture, giving an input about a topic.

EXPERT LECTURE: explaining theories, concepts and giving examples about specific principles.

GROUP WORK: working together in a group in a focused way. Most of the work in the two weeks was organized through different types of group work.

WORKSHOP: a task that is done by using hands-on methods.

PLENARY DISCUSSION: aspects or issues are discussed in plenum.

PRESENTATION: a recording of an event, building, object or phenomena.

DRAWING: digital and analogue records of a structure/building.

PHYSICAL MODELS in different scales.

ESSAY: textual, often personal reflection of aspects and issues in the context of architecture.

FILM MAKING: an artistic record of the event, in this case the one-week workshop, that contains both factual information, but at the same time is presented in a very personal way giving it a level of an artistic dimension.

EXPERIMENT: exploration without knowing what and in what range the outcome will be.

PHYSICAL MODELS: experimentation: exploring with physical models.

SUPERVISION: giving input and guidance without providing a specific answer.

CONSULTATION: specific expert supervision.

TUTORING: general supervision.

PEER-REVIEWING: involving a larger (student) group to give input on a process or finished design.

ABSTRACTION: abstracting a specific phenomena (as buckling behavior).

LEARNING THROUGH EXPERIENCING: experiencing a phenomena, without neccessarily understanding why the phenomena is occurring.
5 Process and Implementation
Chronological development
As described in point 2.
Development of contents | Outputs
See Case Tree in: Page 43.

6 Reflection
Reflection on the teaching strategy | Methods | Tools
The course was very successful on more or less every level. It was great to see the huge level of engagement of 180 students who were fully engaged throughout the two weeks and who did not stop working. In my view this was the case because the course was interesting, in many ways intriguing as the students first had to do a task and only after that were told why. Also, the level was right. And it was really fun as well.

Reflection on the quality of the outcome
The work produced was of exceptionally high standard. We had several exhibitions which were invited to be part of the Copenhagen Culture evening, an event open to the whole city. It was amazing what such young students could produce in a very short time.

Reflection on the learning output
They certainly learned a lot about basic structural principles. One could have not wished for a better output.

Reflection on the interdisciplinarity
Structures are part of architecture, and when teaching students without a mathematical background – this is an excellent approach. Aspects of it would be applicable to an engineering course. However, not completely.

Comment on the case: could the expected aims be achieved?
Yes, fully!

Comment on the communicative structure: Communication within the group/with the teacher(s)
The communication was completely informal. That helped achieve the good results.

01 It is important to emphasise that some of the students have no mathematical/structural grounding from their previous education.
Course 11599
Large Scale Structures in Urban Context (1st Part)

1 Strategy and Content

Content of the case
The course 11955 is a large design project course where the main strategy is to set a project in a realistic framework through a collaboration with a municipality. Secondly the strategy is the focus on specific design method, and the transition from one design phase to another. The project has a real site chosen by the municipality of Copenhagen for its complexity and obvious problems. The idea behind the course is a transition from a completely blank sheet where gradually more and more disciplines are added: traffic, climate adaptation, solar conditions on the site, history, a new programming and storytelling for the site, conceptual structural design, geometry. The disciplines that are integrated in the design project are added according to a kind of meta version of a commercial project going from the urban scale to detail. The idea is that the new programming and story for the site should be made manifest in a structure. And this structure must be defined in terms of structural design and geometry.

Teaching strategy and learning output
The project aims at ensuring a realistic collaboration with a municipality about solving a real urban scale challenge in the city. The teaching strategy is a sort of method transfer, where engineering students use the methods of artists and architects, while also having periods where they use their own engineering methods. The overall teaching strategy is to start with a very large level of complexity, and through the methods taught to the students, they are made able to handle the complexity and gradually make it operational and fitting to a design project.

The learning output is knowledge of how to preserve the initial conceptual design ideas for the site when defining the project more and more and going from one the design phase to the next. Actually from scratch to a completely geometric and structurally defined proposal.

2 Boundary Conditions

Format of the case
Design studio, B.Sc. Level, 3rd semester, mandatory, 13 weeks, 5 ECTS (135 hours). Course 11955

Group of participants
Participation requirements: students must have passed the first two structural mechanics courses, two BIM courses, an architectural history and architectural design course before entering course 11955.

3 Interdisciplinary Character of the Case

The interdisciplinary elements derive from different design phases that are both very artistic and very technical / engineering oriented. The long term, open-ended and complex project serves as a backcloth for both artistic exercises and engineering analysis. Combined the exercises or teaching elements outline a full interdisciplinary design process including artistic, architectural, urbanistic, engineering and mathematical methods. However, the students involved are all engineering students, though from a line of study where emphasis is on design.

The interdisciplinary part of the project is primarily in the very early focus on conceptual structural design. The course is structured in partial deliveries where posters and model photos are uploaded. Just after deciding on the new story or concept for the site the students start working on structural concepts. The idea is as mentioned to make the new programming and story for the site manifest in a structure but the structural design also influences and enhances the initial story. The course 11955 takes place every Wednesday from 8-12. Parallel to this the students have a number of other courses. One of these courses is a geometry course (course 01237) given by the Math. Department. In a joint half day workshop the students present near-finished projects and the geometry teachers take part in an atelier critique of this. The geometry teachers then directs the attention of the students to hidden geometrical problems in their projects. These problems are then addressed in a report that is assessed in the geometry course but the results are implemented in the design project.

4 Methods and Tools

Role of the teacher(s)
The studio course is predominantly student-centered with the teacher as consultant and moderator. Only during few input lectures the role of the teacher switches to a more teacher-centered teaching. However the project is tightly structured for the first 6 weeks with weekly deliveries that must be uploaded.
Methods

**INPUT LECTURES** short lectures to frame the next design phase and give directions, contextualize it with respect to the goals of the course.

**EXPERT LECTURES** Lectures on rules of thumbs (zooming out) and structural system design.

**GROUP WORK**

**TASK FORCE TEAMS** not working in design team students are analyzing specific task, works as background for the design project (like traffic, wind). The aim is to foster cooperation, sharing information and submitting knowledge from group to group.

**DATA COLLECTION** urban analysis, conducted by the task force teams, that studies:
- Site history from municipal resources
- Current and previous municipal plans and strategies for the site
- Climate adaption plans
- Wind analysis: 1:200 models of 4 places around the site and on the site to conduct wind analysis (wind tunnel)
- Sun conditions in the area (Sketch up 3D model)
- Traffic strategies for the area — especially planned super bicycle lanes.
- The above described is presented in an A3 SIZE REPORT and is assessed by the teacher with comments on the intranet and at the oral PRESENTATION.

**GROUP WORK**

**DESIGN TEAM** collaboration, working together transdisciplinary, influencing others by presentations, exhibitions with gallery critiques and lectures and supervision. During the first two weeks in the autumn part of the course (before the Christmas break), the students together gather information through a task force team structure. The rest of the time, after that, work in design teams until the final presentation before Christmas. This pattern is repeated again in January where the students for the first week, work in task force teams with structural systems and simulations in the software robot. And the last two weeks in January the students again work in design teams, and adjust the universal structural systems to a real project in a real place in the city.

**INDIVIDUAL WORK**

**ARTISTIC AND INTUITIVE EXERCISE** where students are given 4 pictures that they should create a story from. This works as a warm up for the individual exercise the students do by the end of the bicycle excursion.

**EXCURSION** The site is visited by means of a bicycle excursion because “super bicycles routes” is the main traffic strategy for Copenhagen.

**STORY BOARD** students individually write new stories for the site, which also include ideas for new programming as a kind of conclusion or result (synthesis) from the bicycle excursion.

**COLLAGE** students upload individually 2 A2 posters with the new stories for the site as collages of texts and pictures. This is assessed by the teacher only with individual comments in the intranet.

**INTERIM INDIVIDUAL PRESENTATION** Based on the individual stories for the site (the two A2s) the design teams meet for the first time and decide on two concepts for the project.

**SILENT GROUP PRESENTATION** the two chosen concepts are presented as 2 A0 posters. The 2 Aos mentioned above are evaluated and interpreted by the teachers without an oral presentation by the students. Graphical communication is important in order to communicate and develop ideas in the design team and it is equally important in order to preserve the character and atmosphere of the project when it becomes increasingly more and more concrete during the progression of the design process.

**EVALUATION FOR DECISION-MAKING** choosing which kind of structures would be suitable for making manifest the new story for the site and at the same time solve some practical problems in the areas such as lack of recreational areas, noise pollution, large roads as barriers etc.

**PHYSICAL MODELS** Structural concepts studied through cardboard models in scale 1:200. The structural concepts should both make the new story manifest. Photos of cardboard models of structural concepts are uploaded on the intranet. They are commented orally by teachers during the atelier round.

**SUPERVISION** in the design teams by both architect and structural engineer supervisor. Communication within the group: The students are supervised 4 hours a week or instructed concerning the next weeks delivery. (The rest of the week they have other courses). Communication with the teacher(s): There is one teacher in the course that talks with each student group once per week approximately 20 minutes per group. Discourses carried out: reflections concerning design methodology.

**GROUP WORK** next steps in the design team are:
- Design of overall structural system
- Structural calculation by means of rules of thumbs and diagrams that explain how the structure works (students learn staad pro in the next semester).
- Zooming in on one special detail (to give the character of the project).

**GROUP INTERIM PRESENTATION** preliminary version of the final project proposal presented with 5 A0 posters in a workshop with the geometry course. An architect, an engineer and the geometry teacher give atelier critique concerning overall design, geometrical problems, structure and structural calculation.

**GROUP WORK** next steps in the design team are:
- Integration of ideas for optimizing the geometry.
- Optimizing the graphical communication.
**5 Process and Implementation**

The teaching takes place in a realistic framework given by the site in Copenhagen. The project is divided in project phases that are introduced by lectures given by employees from the municipality and by the teachers. The students form 5-6 person design teams. The first two weeks of the course the design teams are not in operation but members are distributed in urban analysis teams that study site history, municipal plans and strategies, climate adaption plans, wind (wind tunnel of 1:200 models) and sun conditions in the area and traffic strategies for the area. They produce an A3 landscape size report for all the design teams to use later on as background material.

Then the site is visited by means of a bicycle excursion and the students individually write two proposals for a new story for the area. The first meeting in the actual design

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**Tools**

**URBAN ANALYSIS** study of documents from the municipality

**SUN ANALYSIS** tool: sketch up model used for mapping the annual sun in the area (and shadows).

**WIND ANALYSIS** Yool: 1:200 physical model, wind tunnel test, analyze the photos from the wind tunnel test in MABLE

**INTERVIEWS AND QUESTIONNAIRES** how do the inhabitants see the area (POE)?

**STORY BOARD**

**COLLAGES** combination of photos and own sketching to communicate a new story for the site

**ANALYTICAL SKETCHING** on maps to merge the new story for the site with an overall urban strategy and plan. Creating architectural diagrams that communicate the concepts and make them manifest and operational in the project.

**ANALYTICAL DRAWING** choosing a place in the structure where to zoom in and create a detail (section) in 1:50.

**PHYSICAL MODEL** conceptual structural design by means of card board models in 1:200 and structural rules of thumbs

**SIMULATION** of structural system through ROBOT or other professional finite element software —— supplemented by rules of thumbs.
team is when the students present their individual proposal for a new story for the area for each other in the design team.

The structural design part of the project is introduced very early — just after the basic concept and new story/programming for the site.

The structural design part of the project is introduced very early — just after the basic concept and new story/programming for the site.

Reflection on the quality of the outcome

The quality of the outcome is higher than what could be expected from 3rd-semester students, because they are introduced to a step-by-step interdisciplinary design process.

Reflection on the learning output

Especially the January course is very intense and demanding, however, this tour de force gives the students a chance to learn how to maneuver in a large design project by themselves. In the January part of the course students are supposed to utilize themselves the interdisciplinary design process taught to them during the autumn.

The projects, in general, showed a very high level in all design phases and a great care for the transition between the different design phases.

The students work very hard and their workload is a lot more than what is formally required. This is a not a problem because they could get an average assessment, but they choose themselves to work harder to get a better grade, or more importantly, because this project exposes the potential of integrated design which was why they chose DTU architectural engineering in the first place.

Reflection on the interdisciplinarity

The interdisciplinarity of the different exercises that make up the entire project is the main focus of the course.

The integration of urban planning concepts and structural concepts from very early in the design process is the engine in the work with interdisciplinarity in the course 1955. It is an experience for students that they see for themselves that structural design can generate architecture – even on an urban scale. They are told in lectures that infrastructural projects today have to honor much more than just bridging from A to B, but in this course they experience that it can be done.

The integration of mathematical geometry and structural design (and urban design) is done by the simple 'tool' of a half-day workshop.

Comment on the case

Yes the aims are achieved.

The described teaching strategy is applicable to third semester students with an architectural engineering background. Often these kinds of projects appear in the 10th semester as key stone projects of MSc students. However, it is important to introduce early on the notion of and methods to deal with interdisciplinarity, because it then becomes a backcloth for all later disciplinary teaching and learning.

Comment on the communicative structure

The challenge of the course is the need for both engineering and architect's supervision of the design teams which is very demanding for both the architect and the engineer. The communicative structure is organized around the weekly uploads and the lectures and task descriptions that are attached to the weekly uploads.

Development of the Contents | Outputs

See Case Tree in: Page 51.

DO DESIGN: these are more or less the tools and their outcome

THINK DESIGN: these are more or less the methods and their outcome

6 Reflection

Reflection on the teaching strategy | Methods | Tools

This teaching strategy is focusing on structuring an open-ended interdisciplinary design project by presenting design methods with specified tasks and tools that make up method elements from urban planning, artistic work, architecture and engineering, and math/geometry. The aim is to arouse attention concerning the movement from one design phase to the next – how design decisions are made. To achieve this, both very artistic exercises and very engineering oriented exercises, are presented to the students.

Since it is the first time in their study that students are to create such a large project a lot of care and optimization has been made during the 12 years that the course has existed in making the process understandable to the students. A set of well-structured lectures, matching the weekly delivery descriptions, draw an interdisciplinary path for the students to follow in the overwhelming open space of such a large project. This clarity in the organization leaves students the space for observing the interfaces from one phase of the project to the next.
Climatic Architectural Device  
Autumn Studio 2015

Master of Architecture in Extreme Environments

Royal Danish Academy of  
Fine Arts, Denmark
Institute of Architectural Technology

1 Strategy and Content

Content of the case
The proposed semester studio explores the idea that designers can create customized tools named “architectural devices” to research and comprehend the magnitude and the quality of hyper-specific site conditions and inform design. The devices are designed and fabricated by students attending the Master of Architecture and Extreme Environments at the Royal Danish Academy of Fine Arts School of Architecture. They range from body equipment to body shelters up to spatial installations. The devices are sensitive and reactive to bounded conditions, adapting their form, aspect, color, light, and position. The tools visualize the hidden potentials for regenerative solutions interrelated to the cycles that characterize a place (e.g., thermal, water, flora and fauna, human cycles).

Teaching strategy and learning output
The devices are adopted in the context in extreme climatic conditions. They are situated in difficult areas as a mean of learning how to capture sensitive data. The devices retrieve information of energy potentials, pollution, temperature, breezes, humidity, rainfall, sky condition, light quality and their interplay. A variety of devices reveal how they form a link to fine-tuned design tactics. The teaching is thus aiming at an individual exploration of the space and the development of an awareness of environmental factors. The studio is aiming at a complete prototype proposal from a research phase to the construction and the testing on site. This is the primary teaching output.

2 Boundary Conditions

Format of the case
Semester design studio, master level, 10 weeks

Group of participants
20 M.Arch. students; specific set of skills is required: research abilities, modelling and fabrication skills, scientific approach, structural and material understanding

3 Interdisciplinary Character of the Case

The design exploration within the studio is based on the definitions both their problems across the borders of: architecture, structural and material engineering, climate analysis, environmental studies, fabrication, chemistry, physics, biology, chemistry, ecology. The disciplinary perspectives are integrated.

4 Methods and Tools

Role of the teacher(s)
The studio course is predominantly student centered with the teacher as consultant and moderator. There are a group of researchers involved into climatic design, sustainable design, simulation modelling, data acquisition, material understanding, structural behavior, constructability aspects and technique. Several input lectures are provided by specialists from different fields ranging from biologist to anthropologists.

Methods

INDIVIDUAL LECTURES: short lectures on climatic, sustainable design and use of tools, materials, structural design, deployable and transformable structures with direct input into the architectural device character and scopes

THEMATIC WORKSHOPS: Group of 4 works in the first weeks to create a test facility for their device, the test facility reproduces extreme conditions that students will find in place once they reach the extreme environment

REQUIRED READING: a collection of theoretical and technical texts is selected by the students that operate a literature review, which students have to work through in parallel to the device development. This should help to confront their practical work with the ongoing discourse in science.

FABRICATION: students make-fabricate their devices, that have to be light-weight and lightweight to transport by plane, ready for deployment and use on site

TESTING: students test their device reproducing the extreme conditions in self-made testing rooms

REVIEWS: summary of weekly developments on the base of physical models of the prototype.

COMMUNICATION of the basic ideas and findings only though precise drawings and diagrams.

EXTREME ENVIRONMENT ONSITE VISIT: students locate their device on site and collect data in a real extreme environment

FINAL PRESENTATION: each of the students presents the outcome of their designed prototype. Reviewers are internal and external with a critics visiting from abroad.
PORTFOLIO DOCUMENTATION: the studio does not end with the final presentation but rather with a final documentation that functions as a reflection of the process. Students are required to prepare a graphical portfolio. Findings are used to inform an architectural development of an architectural proposition, which happens in the second semester.

Tools

PROTOTYPE: The Architectural Devices are brought, deployed and tested within the territory in question. These assemble act as hyper-specific study agents and as experimental measuring medium to scrutinise, measure and cooperate with the complex environment.

TEST ROOMS: An introductory, experimental driven phase, aims to perform climatic and material tests based on scientific research methods.

FABRICATION WORKSHOP (e.g. metal workshop), targeted at constructions, are devised to satisfy the demands of scientific research while studying practical, visual and spatial entanglements. There is a specific requirement on lightweight transformable structures.

FIELDWORK, implies the installation of the device, its fine tuning and the acquisition of data. The investigation pursues a site-specific climatic and environmental investigation.

CLIMATIC AND ENVIRONMENTAL TOOL: a series of equipment is used by students: thermal cameras, drones, 3D scanner, data loggers of any type of climatic and pollution conditions.

Chronological development

See Case Tree in: Page 59.

10 weeks long studio organized four phases:

- An introductory, experimental driven phase, aims to perform climatic, material and structural tests based on scientific research methods.
- The second phase, targeted at constructions, is devised to satisfy the demands of scientific research while studying practical, visual and spatial entanglements.
- The third step, the fieldwork, implies the installation of the device, its fine tuning and the acquisition of data.
- The fourth phase presupposes the breakdown and processing of gathered data.

Development of the contents | outputs

- In the first phase, students create artificial test rooms. Also, they could exercise with the modelling of materials that they could detect in the extreme locations.
- The devices are made of an organic composition (biotic) and a synthetic (abiotic) material.
- In the second phase of prototyping, students operate in the manufacturing workshop. Performances and costs are discussed with researchers in sustainable design, building physics, material, structure and industry manufacturers.
- Assembling the final prototype is a design hurdle in itself, as limitations in transportation are a restriction. A lightweight, transformable and easy-to-assemble design, which partially relies on local materials is essential.
- The fieldwork phase is concerned with surveying and mapping the environment through the constructed device.
- Beside gathered knowledge from the process, students examine local phenomena and can ascertain design hypotheses instantly.
- As opposed to developing a hypothetical or uncertain interpretation of the site from data such as weather file and environmental records, the architectural device enables the direct measure of local microclimates and ecosystem and the examination of regenerative ideas, this before fixing any design option.
- The fourth phase, is about reporting in graph all the measurements that were made on site, data are interpreted and processed and the “learnt lesson” described.

5 Reflection

Reflection on the Teaching Strategy | Methods | Tools

Engaging through design and manufacture before the departure to Brazil, students were able to construct devices to chart specific conditions related to a chosen field of interest. Drawing inspiration from different science and technology domains, and with a specific focus on climatic and natural cycles, students devise were able to visualize and measure phenomena (amplification of the phenomena) while testing solutions able to engage and control the phenomena itself, thus providing design inspiration for the site regeneration.

Reflection on the quality of the outcome

The architectural devices establish a visual clarity and hierarchy that manifest the details of complex phenomena. The complex phenomena understanding and control by design was achieved by the means of the interdisciplinary process.

Reflection on the learning output

Students learnt how to research, gather knowledge from different disciplinary domains. They learnt to synthesize data from different formats to inform design. They learnt how to test the validity of design choices by onsite verification. They also experimented with aesthetic potentials arising from scientific data recording and presentation.

Reflection on the interdisciplinarity

The interdisciplinarity is manifested in one object. The architectural device is aimed to relate to climatic processes, biological sciences, sophisticated structural and mechanical
Comment on the case
It was found difficult to communicate the multiple performance offered by the devices in a clear report format. While the architectural potential communication was fully communicated, it is necessary in future to adopt reporting methods (e.g. data collection) derived from scientific disciplines. This may be beyond the scope and needs of an architectural education, but if developed in partnership with other/more scientific or engineering students may benefit the latter. As the devices are quite creative and ambitious the collaboration may also lead to the development of novel components, devices or approaches that can benefit society.

Comment on the communicative structure
Communication within the group | with the teacher(s). Discourses carried out. The communication happened mainly on individual bases. Each student also engaged with different disciplines and expertise depending on the specific research design path.
1 Strategy and Content

Content of the Case

The series of the block courses are the elective seminars and were realized in the form of workshops based on additional forms of education (student exchange programmes, international winter schools, joint courses, distance learning and lifelong learning).

The course was designed to explore the topic of multi-layered and multi-sensory reception of public spaces and the consequences of such acceptance to build more complete design concepts. The subject of the course covered the issues of public spaces and their transformation in the context of an interdisciplinary design, mainly alternative interventions in public spaces. The main medium used in the workshops in Gdansk was sound.

The Light City Sound / Sound Space / Light City Sound 2 Block Elective seminars are an introduction to the wide range of possibilities in design arising from phenomenological approach of the perception of the space, and the complementary courses to Architectural Design based on experimental methods of learning.

Teaching Strategy and Learning Output

Generally based on the two parts:

1 part — workshop with experiments to get familiar with the medium
2 part — studio with the creation process based on the knowledge and experience gathered in the preliminary stage in the described examples. Despite the equal learning output the teaching strategy differed slightly.

The teaching is aiming at an individual experience and exploration of the spatial potential of the space in term of using non-typical medium like: light and sound. The exploration and experimentation with different medium brings an awareness of perception of architectural form and space.

The course explores the problem in the form of experimental methods adopting different means of expression typical for other arts. It is aiming experimenting action level of representation more at a schematic design level. It explores issue of sound and light in the space and its importance on design level.

The primary teaching outputs are:

- to get familiar with:
  - design of public spaces and buildings as a part of multi-layered built environment including at the special spaces as spaces of specific sounds, multimedia,
  - needs and expectations of the recipient of these public spaces,
  - the conditions and possibilities of implementation due to the conditions of a given area, as well as the technical guidelines and regulations.

- to transfer knowledge about:
  - the scope of the rules and requirements in the development of an interdisciplinary approach to public spaces accessible to all.

- to understand:
  - the principles of shaping the special spaces responding to social needs and design in the context of space.

- to train students to:
  - search for the appropriate design elements, draw conclusions from the analysis and their proper use,
  - anticipate and adapt to the needs of all users,
  - use an interdisciplinary element to design and create connections in space,
  - analyse public spaces for their multisensory perception.

2 Boundary Conditions

Format of the Case

Block Elective Seminar, Master level, 1-2 weeks, 2 credits (= 3x30 hours)

Series of 3 Block Elective Courses in the form of workshops:

Light City Sound — Hacking the City / Urban Acupuncture
Transformation of the public spaces in the contexts of interdisciplinary design

The course organized in cooperation with Eindhoven University, Unit Architectural Urban Design and Engineering Department of the Built Environment and Gdańsk University of Technology, Faculty of Architecture as a joint course at the both universities: GUT and eTU. The on-site workshop took place in Nederland in Eindhoven from 13th to 17th of November 2012 and in...
Poland in Gdansk from 17th to 20th of November 2012. The workshop was an initial part of an elective seminar. The tasks undertaken during the workshop were elaborated during the semester after the completion of the workshop. Elective seminar was proposed for the second semester of Master Level Students.


Excursions: on-site Visit, and group Walking Tour: Narracje festival, Gdańsk 2012, photo: J. Borucka

Sound exercises and experiments: Measure of the Sound workshop within the course, Gdańsk University of Technology, Gdańsk 2013

Testing / Monitoring: Sound exercises and experiments; Measure of the Sound workshop within the course, Gdańsk University of Technology, Gdańsk 2013, photo: J. Borucka

Sound exercises and experiments: A sound-walk is an invitation to give our ears priority over other senses” (Westerkamp 2014, 1974)

Sound Space — Intervention in the public space
Transformation of the public spaces in the contexts of interdisciplinary design 2

The workshop organized as a part of the project Soundplay prepared in cooperation with The Łaznia Centre for Contemporary Art in Gdansk and Department of New Media Art Academy in Szczecin. The workshop under the title Sound Measures took place in Poland, Gdansk on the campus of Gdansk University from 18th to 22nd of March 2013. Elective seminar was proposed for the first and third semester of Master Level Students.

Light City Sound 2 — Hacking the City /Urban Acupuncture
Transformation of the public spaces in the contexts of interdisciplinary design 3

The course organized in cooperation with Eindhoven University, Unit Architectural Urban Design and Engineering Department of the Built Environment and Gdansk University of Technology, Faculty of Architecture. The workshop took place in Nederland in Eindhoven from 9th to 15th of November 2013 and in Poland in Gdansk from 15th to 19th of November 2013. The workshop was an initial part of an elective seminar. The tasks undertaken during the workshop were elaborated during the semester after the completion of the workshop. Elective seminar was proposed for the second semester of Master Level Students.

Experiments in anechoic chamber at the Audio Acoustics Lab at Gdansk University of Technology / Sound exercises and experiments, Gdańsk 2012, photo: J. Borucka

Experiments in anechoic chamber at the Audio Acoustics Lab at Gdansk University of Technology / Sound exercises and experiments, Gdańsk 2012, photo: J. Borucka

Students Project: Digital soundmap of Gdansk, GUT, Gdańsk 2013
Group of Participants
25 Master students; no specific set of skills was required but activity and engagement were beneficial.

City Sound / Sound Space / Light City Sound: Block Elective seminars involved different levels of Master Degree Students from such disciplines as: Architecture (Gdansk) and Engineering (Eindhoven), Art (Szczecin). In case of Sound Space beside the students, there were also participants from the public and local community engaged. The size of the groups for each course and workshop was about 25 participants.

3 Interdisciplinary Character of the Case

Interdisciplinary Topic
The experimental exploration within the seminar (involving artists, architects and engineers) concerns interdisciplinary topic of sensorial aspects of space and convergence of arts within disciplines of architecture and engineering. The various disciplinary perspectives are integrated.

The course is based on an interplay of methods in examination of the sensual qualities of urban spaces and its potentials. Under this focus the workshop and studio work aim to introduce a new approach to widen the architectural/urban perception by presenting unusual means of architectural expression and concentrating on social and spatial interpretation. Such a new experience allows getting involved in an interdisciplinary search both for discovering new design methods and new presentation methods in an architectural studio.

Student Group and Involvement
The seminar aims at a merging of disciplines through the participation of students of engineering, architecture and the art. As the case studies refer to the international level, this assured also cultural diversity. Additionally, in case of the workshops there were public actors involved.

4 Methods and Tools

Role of the Teacher(s)
The course is mostly student-centered with the teacher as consultant and moderator. However, there are different role of the teachers on different stages of the work during the seminar foreseen. In the preliminary stage during the introduction part the teacher or expert is transmitting knowledge to a group in the form of Lectures both: Input lectures (short and general lecture, mapping the context and giving introduction) and Expert lectures: (specific and any length lecture on specific topic). On this level there is also the Brainstorming versus Reflection and Discussion with the teaching staff (teacher, invited guest: experts or artist) foreseen. Teaching Staff are the leaders presenting the topic and exercises, the set up and introducing the course (workshop).

During the development of the work the participants (the students) are the main actors of the works (Group work) guided only by the leader (teacher, artist). Teachers act as critics and consultants during the Discussion rounds and Supervision / Tutoring.

In the final stage, all participants are equally engaged in the creation process of the outcome (e.g. through the Presentation and Documentation).

Methods
The main aim to get familiar with the different medium was realized by:

LECTURES
Input lectures as an introduction: short presentations describing the content, target and aims of the course (at the beginning of the seminar) and each task (during the seminar)

EXPERT LECTURES short seminar or instruction on specific thematic given by the teachings staff and invited experts (during the course)

INDIVIDUAL WORK

Based on participation in the form of observation and analysis of: Synthesis of:

INDIVIDUAL TASKS EXERCISE (Exercise + Project) preparing students in to the experimental phase including simulation, excursion, mapping, and CASE STUDIES Required Reading text and projects, the students read and analyse texts and projects individually

GROUP WORK based on participation in the form of Task Force Team and Design Team to do/ in the form of:

EXERCISES work within the group elaborating small tasks engaging students in the creation process

EXCURSIONS including On-Site Visit, and Group Walking Tour

DISCUSSION ROUND group discussion based on the required reading and project examples, as well as brain storming in the creation stage (Explore). Discussion is student-orientated and teachers serve as moderators

EXPERIMENT / TESTING experimenting with the medium, group and individual experiments

CONSULTATION, CROSS-CRITICS, PEER-REVIEWING discussion led by teaching staff and invited experts within the group of the students with their great involvement; reviews given by the leaders (experts and teachers)

in order to prepare:

PROJECT (Exercise) as a long term and complex work and

TESTING / MONITORING test it in the form of prototype and creation of a model (Physical Model)

PRESENTATION as a

MID PRESENTATION summary of the experimental stage in the form of individual and group communication

FINAL PRESENTATION each student presents final outcomes of the seminar based on their own experiences (individual presentation) and as group (group presentation — performance with the involvement of all participants of the seminar: students and experts) abstract presentation (presentation without review)
the seminar required the documentation of the final performance and individual experience, there is individual documentation foreseen as well as documentation of the performance in the form of publication (Drawing, Sound and Film Making, Poster, Report).

Tools

Part 1: Observe, Describe, Analyse, Experiment

- **FIELD TRIPS**: individual and group participation in specific City Space Festivals as examples of various interventions in the public space
- **SOUND WALKS**: specific study walks with a focus on listening to the environment, participants get interested in the implications of the changes in city soundscapes and the relationship to the world through sound.
  (sound walking is an important tool used in the process of re-engaging aural senses, an example tool in finding sensual dimension of the place.)
- **SOUND LAB**: an introductory experimental phase enables testing and performing sound experiments
- **STORY TELLING**: reflection on the exploration of the individual, subjective experience
- **DEBATE AND BRAINSTORMING**: exchange of information and ideas based on lectures and discussions

Part 2: Use and Create, Participate

- **EXPERIMENTS**: training and practice of a new medium
- **MATERIAL CREATION**: abstractive modelling in both: the sensual and visual manner
- **PERFORMANCE**: tool required for testing the new medium in the designing of experience by temporal installation or performing a specific music play
- **PERFORMANCE DOCUMENTATION**: sound and film making, photography, drawings in the different techniques

5 Process and Implementation

Chronological Development
Series of three optional elective seminars organized as block courses (workshops): 1-2 weeks, with a focus on sensual perception of the space (Discover: experimentation with the topic) and its consequences for the design (Explore: alternative creation).

The development of the seminar is divided in several stages:

- **STAGE 1**: Introductory, observation and personal experience stage
- **STAGE 2**: Experimental stage aims to understand the behaviour of the alternative material
- **STAGE 3**: Workshop and study stage is intended to implement material and sensorial tests based on scientific research and experimental methods.
STAGE 4 Fieldwork stage is a practical work conducted in the natural environment, after a laboratory experimentation.

STAGE 5 Presentation and documentation

Development of the Contents | Outputs
See Case Tree in: Page 67.

6 Reflection

Reflection on the Teaching Strategy | Methods | Tools
The teaching strategy is to approach teaching of design in alternative experimental way and widen the architectural/urban perception by presenting unusual means of architectural expression. The used methods and tools are adopted from the artistic field and are unusual for the architects and engineers. To some extent they are transformed for the teaching purpose. Drawing inspiration from the artistic field, and with the specific focus on sound and space experience experimentation, makes it possible to visualize and measure non-visual phenomena of the space. Apart from that, testing solutions enables to engage and control the sensual qualities of urban spaces and its potentials. This provides new opportunities for the design inspiration, process and design quality. Engaging through experiments, including personal experience and observation, before the creation phase, enable it to prepare design and installation with the conscious of sensorial, on-visual aspects of space. This also brings a very technical discipline, like architecture and engineering, in to a more humanistic dimension.

Reflection on the Quality of the Outcome
The level of the outcomes was very high. The creativity arises with the following stages of the learning process. Thanks to the interdisciplinary process and engagement of the participants the aims have been achieved. The unconventional approach established new manifestation for the architectural representation and opened new possibilities for design solutions.

Reflection on the Learning Output
Students from the different fields get familiar with the unusual mediums used for space creation. Especially this new approach had a unique impact on students of engineering, who for the first time faced an abstract approach to the subject of experiencing and designing the space.

The participants learned how to analyse public spaces for their multisensory perception. Apart from that, the students experimented within the new artistic field and gathered knowledge from the new disciplines and their specific approach to creation. They learnt how to adopt interdisciplinary elements to design and finally widen their own architectural/urban perception.

Reflection on the Interdisciplinarity
Beside of the interdisciplinarity of the content of the elective seminars, seen as a challenge and opportunity to enrich the discipline of architecture, in addition there was expected to constitute a familiarity to the educational approaches between the partner schools. The teaching staff of the partner institutions representing different fields, as well as, invited lecturers, keynote speakers and roving critics representing wide range of professions and academic backgrounds such as an architecture, engineering, art, philosophy, sociology and urban planning enhanced the interdisciplinary quality of the case studies.

Comment on the Case
The expected aims have been achieved with a great success. The observation of the level of the future outcomes of the participants and of their awareness of sensual aspects of the space benefits in their future design. However, problems and barriers can be detected during the conducting of the above-mentioned case studies. There are mainly differences in understanding the issues and their definitions caused by the different disciplinary backgrounds.

In conclusion, new methods focused on processes of understanding and designing the multisensory dimension of public spaces and thus strengthening awareness about their phenomenological characteristics.

Expected learning outcomes also provide new directions, unique propositions for broadening existing learning programs in architectural schools by adding to their knowledge about sound art and new technologies and scientific research.

Comment on the Communicative Structure
The communication structure was clearly carried out by the teaching staff and experts during the input lectures and on an individual base within the group.

The main issue was the preparation of the communication stage (DISCOVER) where all the new and unusual features were presented and described. In this stage, the personal involvement of each participant, both students and conductors was crucial. This created the base platform for future discussions.

Next, the experimental stage (EXPLORE) was the opportunity to test the information and face new challenges. Was a preparation and starting point for the final creation/experiment in design.
1 Strategy and Content

Content of the case

**CASE I**

**Workshop Zaklete Rewiry — Krynica Morska 2006**

The idea of the workshop was to activate local community and make them aware of their responsibility for the natural and cultural heritage of the small fisherman village Krynica Morska. Krynica is located on the “Mierzeja Wiślana” peninsula. There live less than 1,500 inhabitants, but every summer the village changes into a holiday resort with up to 30,000 visitors during the season. The holiday potential brings the threat of pressure of investments and uncontrolled spatial growth — a process, which already takes place and becomes visible in the pure quality of architecture and urban planning.

The task was to increase the awareness of the inhabitants and all responsible persons of the importance and advantages of proper urban planning and also to help them realize the bad consequences of processes like the uncontrolled urban sprawl and the degradation of the historical substance of the city.

**CASE II**

**Workshop Rebrick 2013 and 2014 — Gdańsk**

The idea of the workshop was to activate local communities of some neglected historical districts of Gdańsk (Dolne Miasto and Nowy Port — edition October 2013, Dolny Wrzeszcz and Biskupia Góra — edition October 2014). All these districts, due to urban mistakes, are suffering of some specific and multifaceted forms of exclusion. At the same time, all of them are inhabited by local communities with strong sense of identity and relationship with the place. Historical and spatial values of these districts are causing on one hand problems, but on the other hand, demand of investments.

The task: to increase the awareness of inhabitants, professionals and local authorities of the importance of proper revitalization and public participation in historical urban districts.

The aim of both initiatives was to create a platform and methods of communication, as well as to initiate exchange and transfer of information, knowledge, and ideas among the different disciplines, partners, and participants involved in the workshop.

**Teaching strategy and learning output**

The strategy of teaching was based on the precise definition of the roles of the involved actors which was to lead to the exchange of information conducive to understanding the positions of each partner. Students of architecture and architects, as mentors, kept the role of coordinators and referees throughout the process. They were also responsible for the directions of the development of the project. The aim was the final acceptance of the results of the adopted solutions by all participants (on the condition of mutual consent between all partners). The participants were obliged to play and exchange different roles within the group of partners in order to discuss various aspects of the task from different perspectives. Communication, observation and the use of precise language were crucial for reaching a common understanding between the partners.

This means, all had to learn the basics of the language and methods of commonly comprehensible form (e.g. by drawing), in order to be able to understand the specificity of the role of the other partner. The side effect was the change of point of view which was enhanced by the possibilities of observation, understanding, influencing and collaborating.

2 Boundary Conditions

**Format of the case**

workshops (3-5 days long) organized by the students of the Faculty of Architecture of the Gdańsk University of Technology, active in the scientific circle BUA (Urbanistyczno-Architektoniczna). The workshops were addressed to students, local communities, local social organizations and local authorities.

**Group of participants**

**CASE I**

Students of the Faculty of Architecture of the Gdańsk University of Technology, local primary school students and their teachers, parents as representatives of the local community, local authorities.

**CASE II**

Students of the Faculty of Architecture of the Gdańsk University of Technology, local communities, architects, urban planners and local social organizations, local authorities.

3 Interdisciplinary Character of the Case

The interdisciplinary character of the workshops is directly indicated by the complex nature of urban issues (spatial, functional, social, economic etc.). There were many diverse groups involved in the workshops, which were representing different disciplines, backgrounds and interests. Local communities, authorities, professionals, students, social activists representing also different professions had to communicate and cooperate using generally comprehensive language, and tools and methods, acceptable for all.
There is also a very important aspect of the cooperation - at the beginning there must be a will to cooperate, which means all participants must be convinced that the idea will bring advantages for all sides of the process. The same applies to the end phase, where conclusions, decisions and solutions should be accepted and implemented.

4 Methods and Tools

Role of the teacher(s)
Generally, the idea of the workshop was based on the principle of partnership, “everybody was teacher for one another” or “everybody learns from each other”. The students of architecture and the mentors (professional architects) were situated in the middle of the net of cooperation, and their role was to moderate the process. An important aspect was to present the results of the cooperation taking into account the trade-offs, the transmitted and submitted knowledge and the shared information.

Methods

1. Integration, team building activities

**Games** Integration phase — important for the further cooperation — learning about the roles and competences of the participants. Each participant, by taking part in a prepared game, learns about the other participants and at the same time presents his/her own expectations, needs and capacities.

**CASE I**
Prepared by students of architecture where the basic terms and elements specific for architecture and urban planning, such as urban space, landscape, composition, etc. are explained in the form of a common play. It included also the building of specific instruments (fun tools) as a support to learn about the specifics of the village Krynica. An input lecture, with the aim of introducing and mapping the context was presented to the school students as residents of the village. During the workshop on-site-visits were prepared and conducted. The observations helped architecture students get acquainted with the specifics of the local architecture and space and to make an initial evaluation of the problem.

**CASE II**
An input lecture, with the aim of introducing and mapping the context was presented. On-site-visits (walking tours) were made by all participants to collect observations. The students had to prepare short presentations to express their own perspective on the problematic joint with the historical district of Gdańsk.

2. Collecting and processing of the information

Brainstorming on the workshop topic in the form of a short seminar, participants, regardless of skills, were obliged to take notes (e.g. in the form of drawings) with analysis of the city landscape, space, architecture, maps of emotions etc. (drawing as a method of analytical and mental incorporation of the space).

3. Workshop

working on the ideas – the formula of the workshop allows producing many different approaches to the same problem by consultations, peer-reviewing, discussions. All participants were working in several groups. The work was based on cooperation, sharing information, submitting knowledge, transdisciplinary collaboration. The outcomes were presented in the form of a project. This form allows testing different solutions presented and discussed during the public presentation.

4. Public presentations

The final presentations were prepared to spread the outcomes to the public (local authorities, media etc.), which demanded the use of generally comprehensible methods of communication, like models (physical and digital), visualizations, films (even posters or postcards) etc. The most important during this phase was the revision of the whole work in synthetic conclusions in order to ensure possibly the most universal character of the outcomes.

**Tools**
On-site-visits, lectures, interviews with locals, presentations, brainstorming, playing and exchange of roles, films, drawing, models, presentations, visualizations, exhibitions.

5 Process and Implementation

Chronological development
The presented workshops had an intensive character and lasted 3-5 consecutive days. The timing was dependent on the individual decisions of the participants but generally it could be divided into three phases:

**FIRST PHASE (1 DAY)** preparation by input lectures, interviews, games (integration), presentations, on-site-visits, observation, understanding the problem, mapping the context etc.

**SECOND PHASE (DEPENDING ON THE WORKSHOP, 2-4 DAYS)** work on the ideas, looking for solutions, down to earth-method, collection and processing of information, brainstorming, peer-reviewing, working in groups, cooperation, sharing information, submitting knowledge, transdisciplinary work.

**THIRD PHASE** presentations, synthetic conclusions presented in an “easy to consume” way, possible to share with the public (visualization, models, end discussions)

**FOURTH PHASE** The Rebrick workshop had its second edition (the plans were to continue the workshop as a cyclic event, however, not realized), in order to revise the outcomes and also to implement the collected experiences in the next cases (in the city of Gdańsk) addressing similar urban problems. The core of the idea was both, to improve the formula of the workshop and to advance the level of the outcomes for the future.

Development of the contents | Outputs
See Case Tree in: Page 75.
I PHASE  PREPARATION / PURPOSE
Recognition of the field of operation:

- Identification of the actors - presentation, identification of expectations, constraints, common fields
- Targeting the direction (abstract, poetic, imaginative- overall objective)
- Definition of principles

Preparations:

- Integration (play, games, exchange of the roles (EMPATHIZING)
- developing a common language (COMMUNICATION)

II PHASE  ELABORATION (EXPLORE)
Detailing:

- brainstorming
- collection of information (sightseeing, interviews, research)
- developing of ideas and concepts
- limitation/evaluation
- elimination
- selection of the solution(s)

III PHASE  DELIVERY (PROPOSAL)
Presentation of the solution:

- bringing the results into a form which is communicable to public
- discussion
- revision

6 Reflection

Reflection on the teaching strategy | Methods | Tools
Reflecting on the teaching strategy, it is very important to mention, that the methods and tools, which are applied during such kind of workshops, have to be described at the very beginning of the work process. Already in the initial phase (I Phase) all participants should be prepared about their role, and about the possible means that would lead to the final result. This is crucial, because it enhances the possible spectrum of collaboration among participants who have different disciplinary backgrounds. The quality of the outcomes is fully dependent on the participants, their engagement, understanding of each other, and understanding of the problem and the aim of the workshop.

The learning output, both for the participants and the teachers/mentors, can be strengthened by a reflection made after the Delivery phase (phase III). There is a chance to enrich and widen the effect by making general conclusions and elaboration of the
results into a form which allows implementing the results during the next editions of the workshops (or by a publication). The lack of phase IV (discussion with local politicians, publication) was clearly visible in Case I — Krynica workshop, so the chance for the real change in the spatial development of Krynica village was lost. In Case II the final discussion, reflection, and experiences were taken into account in the next edition of the workshop in 2014.

The interdisciplinarity was the planned key-aspect of the workshops, and the multi-faceted tasks demanded engagement of participants with different knowledge and background. This demanded special care for proper communication and collaboration. The interdisciplinary way of searching for the solutions was the only possible way of organizing the workshops.

All selected cases and the experiences concerned with the results of the workshops allow concluding that the expected aims were achieved (in general). Provided that the Phase IV was successfully implemented, the aims in the next editions of the workshop could be formulated then in a more complex way. This phase allows also for the improvement and advancement of the communication structure both within the group of participants and also among participants/group and mentors/teachers (also external persons).
1 Strategy and Content

Content of the Case
An initiative aimed to prepare a civic concept for the development of a courtyard in the historic downtown of Gdansk. The inhabitants of the quarter, before deciding whether to take responsibility for the area closest to them (lease the yard from its owner — the city), will be able, together with the participants of the project, to design the plan of the quarter. During the conceptualization of the project the Design Thinking strategy was used. The project is a bottom-up initiative supported by Gdansk Municipal Property Management Agency.

Teaching Strategy and Learning Output
There were several goals of this teaching strategy:

- **Educational goal** to develop hard and soft skills and competences of the participating in the project students, PhD candidates, people working in NGO’s, academia and business.
- **Research goal** to conduct participatory research by scientists involved in the project who form a multidisciplinary team.
- **Social goal** to support the development of civil society, including stakeholders involved in the project, children, young people and residents of the quarter.
- **Methodical goal** to show and encourage use of wider range of participatory methods in planning and spatial management than previously used in spatial policy of the City.

As stated above the aims of the workshop were wider then only learning, though the educational goal was the most important one.

2 Boundary Conditions

Format of the Case
The case format was a workshop, and its duration was 5 months. The workshop meetings took place once a week for 4 hours.

Group of Participants
Group of 20 - bachelor, master and PhD students of architecture, planning, civil engineering, economy and sociology working together with residents, local NGO’s, academia and business representatives.

3 Interdisciplinary Character of the Case
Involvement of different disciplines, also transdisciplinary involvement of all four sectors: public, NGO’s, academia and business.

4 Methods and Tools

Role of the Teacher(s)
Student centered approach; teachers’ role was limited to mentoring, problem based-approach where students need to work in order to achieve defined aims: together as a group they had to define problems, analyze possible tools and find solutions; teachers only provided the scope of methods and tools.

Methods
The method of **DESIGN THINKING** was used during all the workshop according to the scheme below:

- **EMPATHIZE**
- **DEFINE**
- **IDEATE**
- **PROTOTYPE**
- **TEST**

Design Thinking is to be understood within this case as follows: a method of defining and solving problems in a user-centric, creative and multidisciplinary way. It defines design as a certain way of thinking and working, due to Meinel and Leifers, four basic principles [Meinel, Leifer 2011]: human rule - to satisfy users’ needs; ambiguity rule - to stay open and accept failures; re-design rule - to envision the future understanding the past; tangible rule - to facilitate communication using prototypes.

Those principles are mapped in the 5 steps of Design Thinking process used by the school of Stanford including: **Empathy** — **Define** — **Ideate** — **Prototype** — **Test** [Brown, Katz 2009].

After the tests, several iterations to the earlier phases (prototyping, ideation or even defining problems) were required, which caused the transition of the process into the loop. There was even need to pass through the stage of empathy, as it turned out that participants have not received answers to important questions (in line with Ok2Fail principle — failure is accepted on the early stage each project if it occurs there is a need to change assumption and start again as soon as possible). This approach, though lengthy, aims at developing the most suitable solutions.

Tools
Short **Lectures** and **Seminars** prepared by students were part of the process but mostly the work included observations, interviews, diagnosis of situation (as a part of an empathy and problem definition phase), as well as participatory workshops and discussions (as a part of prototyping and testing phases).

There was a very wide range of tools used in each phase of the workshop.
short introductory **lectures and seminars** by participants strictly connected with the project subject— took place in the initial phase of the workshop and were limited to 15 minutes, aiming to ensure that all participants have a common base-line knowledge.

**Persona Building** tool widely used in user-centered design, a way to model, summarize and communicate research about the different user types; the process takes in consideration not only basic characteristics but also behavior patterns, goals, skills, attitudes.

**Value Proposition Canvas** 03 Tool which helps to define value proposition in a more structured and reflective way; this tool is a part of Business Model Canvas (a strategic management and lean start-up template for developing new or documenting existing business models), which helps to design products and services to answer users’ needs.

**Story Boards** a display of the thinking process in sequence in the form of illustrations or images, for the purpose of pre-visualization.

**Lotus Blossom Technique** 04 a creative-thinking technique that helps to expand thinking beyond usual paths; it helps to organize thinking around significant themes and to explore a number of alternate possibilities and ideas.

**Drawing, Digital Modeling** images were prepared in such a way that citizens were able to understand them without special technical knowledge and could imagine how the space will look like after the transformation.

**Physical Modeling** a 3D model allowed all stakeholders to work actively on the functionality of the courtyard.

**Public Discussions** on the results leading to design iterations — three public discussions were held within the project. Changes in the design had to be introduced after each discussion.

**Model in Scale 1:1** at the location — prototyping using tape and sticks which allowed inhabitants to understand functional changes

## 5 Process and Implementation

### Chronological Development

- Preparation of workshop format (**September 2015**).
- Team members recruitment (**beginning of October 2015**).
- Empathy and problem definition phase (**October – November 2015**).
- Ideation phase (**December 2015**).
- Prototyping and test phases with three iterations (**December 2015 – February 2016**).
- Preparation of project and final rapport (**February 2016**).

### Follow up:

- Agreement sign by stakeholders with the City of Gdańsk (**April 2016**).
- Final conference and on site test in scale 1:1 (**June 2016**).
- Preparation of implementation phase (**participation in Municipal courtyard regeneration program 2018**).

### Development of contents | Outputs

See Case Tree in: Page 83.

### 6 Reflection

#### Reflection on the Teaching Strategy | Methods | Tools

Design Thinking is a strongly defined strategy which systematizes work flow. In the initial phase it allows for the understanding of users and other stakeholders — their needs and expectations; it helps defining the context and the problem from the users’ perspective, and it enhances the further investigation on how needs are to be met and problems solved. The Ideation phase stimulates individual and team creativity in order to find a number of solutions to be prototyped and tested with users. At the same time the implementation of Design Thinking was posing restrictions on the design process, sometimes not giving enough flexibility needed in specific project situations.

Failure acceptance approach of designers throughout the whole process and the iterative form of Design Thinking may be difficult to be put in the frames of a classical university course with is rigid timing and need to redistribute workload throughout the semester.

#### Reflection on the Quality of the Outcome

During the workshop the most important goal was achieved — a civic concept for the development of the courtyard was prepared. Students took part in a real life process of participatory design which was at the end implemented. It was a challenging project for students who had to not only learn new methods of participatory design but also to use them in actual project with the actual users of the space. They learned not only to answer the need of users but co-design with them, to listen to all stakeholders but also to be aware of their own role as experts.

From the point of view of esthetics, being one of the bases of architectural design, it was difficult for students to prepare images which had to be immediate and easily communicated to inhabitants and professions not connected to the built environment.

#### Reflection on the Interdisciplinarity

Interdisciplinarity of participants who moreover were in different stages of their career was both an asset and a challenge for the project. It allowed creating a
A comprehensive solution taking into account different aspects of the design. But it also prolonged the initial phase, as a common platform of understanding had to be created. At the beginning there was a need to establish common language for all the participants representing different disciplines such as architects, planners, civil engineers, economists and sociologists. For example, during the whole project, a special board where each participant could write expressions she or he had heard for the first time or had the impression that the others understand them differently, was placed in the room. We also insisted on not finishing the weekly meetings without having discussed those issues and having worked out common understanding.

Comment on the Case

The expected aims were achieved, consensus among stakeholders was built, the project was created and is going to be implemented. Nevertheless, during the process some problems occurred. At the beginning there were some doubts if we were going to manage to engage all actors to participate in the project. The project was especially challenging as we could only facilitate the process and could not fully influence outcomes such as: consensus building and readiness to sign the agreement, which were vital factors for the project’s implementation.

Comment on the Communicative Structure

Weekly meetings served as a platform to discuss occurring issues and challenges. The main internal channel of communication within the project team was an internal Facebook group. Also a Facebook fun page, as an easy platform for communication with all involved stakeholders, was created.

References:


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01 Project Design Thinking “Urban quarters – non-spaces?” was organised by DoctorAnts, a scientific organisation at Gdańsk University of Technology, and led by Joanna Szechlicka, on behalf of FRAG association in framework of „Design Thinking @ Politechnika Gdańska” initiative led by Joanna Pniewska (Szustakiewicz). Its aim was to promote and educate about Design Thinking as a way of thinking and method of solving problems in an innovative and interdisciplinary terms. ProjektanciKwartalow.pl group worked on the project of urban quarters redevelopment and authored its results.

02 process used by Stanford d.school; see: Tim Brown and Barry Katz; Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, New York 2009.

03 tool was developed at Walt Disney Productions during the early 1930s.

04 tool design by Michael Michalko.
The Study of Urban Spatial Quality. 
Cross-disciplinary approach.
research but as an extended opportunity to thoroughly discuss and debate on the research and the advantages and disadvantages as well as prospects of interdisciplinary exchange in urban research.

**PRESENTATION OF RESEARCH RESULTS**

: the written final report is an extended summary of the content, focus and results of the research assignment with references to literature or any other relevant source having inspired or used for performing the research.

**VISUAL MATERIAL**

: appears in two different forms of information, such as (1) data collected during the research (e.g. photos) either supporting the argumentation in the analysis of research results or subjected to individual visual analysis and (2) design ideas for improving the quality of the studied spatial contexts of the city.

**Tools**

**ANALYTICAL READING**

: of relevant academic texts is considered an important prerequisite to inform and frame thinking, approaching the research problem and further analysis of the research results.

**DOCUMENT ANALYSIS**

: the study of (1) planning documents as concerns the area(s) defined for the research assignment and of (2) any relevant text published in professional journals or media coverage of the site or that would cast light on the phenomena under investigation.

**OBSERVATION**

: detailed in-situ exploration of the socio-physical relationships forming in the research site conducted at different times of a day, in a week and considered in terms of seasonal specificities. Taking notice of particularities of distinct user practices in terms of imagined lifestyles, traditional social divisions as well as in view the local users of city space and guest. Considering specific behaviour patterns in relation to the material dimension of space and activities offered or enabled in research sites under observation.

**VISUAL ANALYSIS**

: varies and depends on the research design, but is always part of the research process – photos as notes from the observation or an individual research activity.

**GROUP DISCUSSION**

: follows the observation with all members exchange their observations, analyse the data and take the decisions on the presentation of research results; this phase is performed independently from lecturer.

**INTERVIEWING**

: individual in-depth (also biographical) interviews with citizens/residents/ institutional agents or focus group interviews - defined in the context of a particular research

**ORAL AND WRITTEN PRESENTATION**

: of research results and design ideas: to develop the skills of argumentation by incorporating conceptual tools and research data into constructive discussion.

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### 5 Process and Implementation

#### Chronological development

The research process is designed on four phases throughout 8 weeks starting with introductions to the main conceptual frameworks and methodologies in urban spatial research, followed by on-site exploration of the subject matter, i.e. conducting the research, and holding discussions in the group. The teaching team provides consultations on how to proceed with critical data analysis, which is performed in group discussions and concluded by developing design ideas to improve the spatial quality of a site under investigation. The presentation on the performance of the assignment is followed by detailed discussion of each group work.

**Development of the contents | Outputs**

See Case Tree in: Page 89.

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### 6 Reflection

**Reflection on the teaching strategy | Methods | Tools**

The course builds on a cross-disciplinary approach towards urban research and with a particular focus on introducing a set of tools and methods applied by urban sociological research in the inquiry of the dynamic of the shaping of spatial quality. The insights into the complexity of intertwined spatial, social, cultural, economic and political processes and the knowledge drawn on the research experience beyond the architectural practice is to enrich reflections on architecture and its meaning as well as the production of quality space through architectural solutions.

**Reflection on the quality of the outcome**

The course seems to work well, especially on advanced levels of architectural studies, when judging upon participating students' engagement and dedication at all phases of the course programme.

**Reflection on the learning output**

Theoretical knowledge and research skills acquired during the course are clearly expressed in students’ performance of the research assignment on critical analysis of spatial qualities transformed to proposals of design ideas. Equipped with extended knowledge and working in small research groups polishes individuals’ capacity to communicate understandings, to debate and advance in creative activity.

**Reflection on the interdisciplinarity**

To some degree the success of an attempt to introduce cross-disciplinary exchange in urban research has come as a surprise to both parties – the students and the academic teaching team. Apparently introducing methodologies and interpretations of conceptual approaches beyond the traditional disciplinary contexts was rewarding and appreciated as enlightening for both reflecting on architecture and spatial qualities as well as for the architectural practice.
Comment on the case:
As mentioned earlier the course suits preferably for the beginning phase of master studies when the participants are more receptive of an understanding of complexities shaping urban space. When conceptualised as part of a broader context of a topic in architecture course, the connections between different approaches and the produced knowledge become more salient.

Comment on the communicative structure:
The logic of communication at all phases meets the aim of the course to provide new insights into conceptualising, studying and discussing the complex processes making spatial qualities.
Neighborhood Guide  
(Апкайму Гидс)—Рига

1 Strategy and Content

Content of the case
The workshop brings together the stakeholders who are responsible for the spatial development of the neighborhood (residents, municipal institutions, a planning office) for a common on site discussion of neighborhood’s problems and possible solutions.

Teaching strategy and learning output
The workshop “Neighbourhood Guide in Darzeni” (Апкайму Гидс Дарзені) is a part of Riga city planning department (Ригас Домес Пилсэтас аттістібас департаментамс, RDPAD) resident engagement strategy. During the workshop the usual communication process between the stakeholders, which usually takes a few months, is compressed to a few hours. No teaching is involved. Learning is spin-off of the workshop, rather than a goal. The stakeholders have to present their opinions shortly and sharply, support their viewpoint with arguments, respect other opinions. Thus, the learning output of the workshop is mastering the art of a constructive debate.

2 Boundary Conditions

Format of the case
Three hour walking tour through the neighborhood, four half-an-hour stops with presentation and follow-up discussion of neighborhood’s problems.

Group of participants
Local residents, experts from municipal institutions and a private planning office, which was commissioned to develop a thematic plan for the neighborhood.

3 Interdisciplinary Character of the Case

The neighborhood has a number of issues, concerning infrastructure engineering (drainage, heating, water, sewage, traffic), urban design and housing policy. Thus, the workshop engages experts from the corresponding fields — municipal institutions and the private planning office, and laymen with the knowledge of the site — local residents.

4 Methods and Tools

Role of the teacher(s)
As already mentioned, no teacher is involved. The private planning office moderates the discussion.

Methods

WORKSHOP, initiated by local residents, co-organized jointly by the city planning department and the private planning office. Identifying spatial problems of the neighborhood, designing route and schedule, inviting experts from municipal and private institutions, preparing short presentations of the problems.

WALKING TOUR, by all stakeholders. Experiencing the problems on site.

POSTER PRESENTATIONS, by local residents and the private planning office. Analyzing the problems, suggesting possible solutions, initiating discussion.

DISCUSSION ROUNDS, by all stakeholders. Commenting on the problems and solutions, analyzing regeneration feasibility, suggesting alternative solutions, searching for a consensus, sketching further actions.

REPORT, by the private planning office. Summarizing presentations and discussions

![Figure 1: Left: poster presentation by local residents. Right: discussion round. (‘Apkaimju Gids Dārzenos’, by RDPAD, 2016, photo by Viktorija Priļenska)](image-url)
ROUTE AND SCHEDULE DESIGN, by the city planning department, the private planning office, local residents. Based on problems and locations, designing the route and the schedule for the walking tour.

VISUALIZATION OF ARGUMENTS, by the private planning office, local residents. Selecting visual materials to illustrate or/and support the arguments.

TAKING NOTES, by all stakeholders for reference.

AUDIO AND PHOTO RECORDING OF THE WORKSHOP, by the private planning office for the follow-up report.

5 Process and Implementation

Chronological development
The preparation of the workshop takes approximately a month (Discover). Perspective participants are contacted twice, a month before the workshop to set the date and a week before the workshop as a reminder. The workshop takes place in the morning during the office working hours (Discover + Explore). The post-processing takes, also, approximately a month (Deliver). The protocol of the workshop is sent to every participant for approval. Workshop results are summarized and used as a reference in a thematic plan of the neighborhood.

Development of the contents | Outputs
See Case Tree in: Page 93.

6 Reflection

Reflection on the teaching strategy | Methods | Tools
Neighborhood guide is an unusual mode of resident engagement. For Riga, and Latvia in general, it is an innovation. The methods and tools are quite usual. The combination of these methods and tools – the strategy, and the field of application are uncommon. The strategy implies that all participants already have sufficient presentation and communication skills, are able to engage in a constructive discussion, have expertise in planning, engineering, urban design, housing policy and/or knowledge of the site. Therefore, the selection of the participants defines the success of the workshop. It is essential, that representatives of the neighborhood association, rather than random residents, are invited. Also, it is important that municipal experts with decision-making capacity are involved.

Reflection on the quality of the outcome
The discussion was constructive and informative. Currently, it is impossible to evaluate what effect the discussion will have on the thematic plan and on the regeneration of the neighborhood. The thematic plan is still in production, but the neighborhood regeneration is a complex process which is affected by multiple factors.
Reflection on the learning output
The participants exchanged their knowledge about the neighborhood and learned about regeneration opportunities.

Reflection on the interdisciplinarity
Contemporary planning is in its essence an interdisciplinary subject. Thus, the topic of the workshop was a priori interdisciplinary. The participants involved had various expertise and background.

Comment on the case:
Could the expected aims be achieved? If not, name the problems | barriers.
The aim, communication with the majority of the stakeholders responsible for the development of the neighborhood in one workshop, was achieved.

Comment on the communicative structure:
Communication within the group | with the teacher(s). Discourses carried out.
Communication during the workshop was emotional, but constructive. Presentations of the residents and the planners were well prepared, with convincing arguments. Some experts, though, were rather harsh criticizing residents’ proposals. The main discussion topic was the financial feasibility of the proposals.

01 Apkaimju Gids Dārziņos — http://www.rdpad.lv/norisinasies-apkaimju-gids-darzinos/
02 Rīgas Domes Pilsētas attīstības departaments, RDPAD, http://www.rdpad.lv
03 2013 city wide survey, where residents were invited to comment on the positive and the negative features of their neighborhoods, unpublished.
1 Strategy and Content

Content of the case

The Baltic International Summer School (B.I.S.S.) is an innovative workshop which allows the development, exploration and testing of different interdisciplinary teaching methods in the context of the built environment. More than 60 students of Urban Planning, Urban Design and Architecture as well as Civil and Structural Engineering, Environmental Engineering and students of Fine Arts and Design worked together in this exclusive workshop. In international and interdisciplinary project groups, the students embarked on self-chosen tasks to reevaluate strategies of the eastern districts in Hamburg, mainly HafenCity, Hammerbrook and Rothenburgsort.

The participants are affiliated to the partner universities around the Baltic Sea (see below). Among the involved departments, institutes or professorships all the different disciplines of the built environment are represented. All the partners strongly believe in the fact that only interdisciplinary approaches can deliver adequate answers for the actual complex tasks and questions arising in the field of the built environment.

The workshop is part of the three-year ERASMUS+ (strategic partnerships) project BeInterBaltic, which contributes to the topic of interdisciplinary teaching and learning in the disciplines of built environment within the Baltic Sea Region.

Teaching strategy and learning output

The B.I.S.S. is a complex format which includes different teaching strategies. Like a "Babushka doll (Matryoshka doll)" it includes different individual teaching strategies in a major one. The overall teaching aims to explore interdisciplinarity and interdisciplinary approaches in the built environment. The students are free to formulate their own questions and approaches as well as to choose their own project to work on within the overall explorative framework of the workshop. The detailed teaching strategy is then influenced by the supervision of the mentors’ couple and their individual input.

Generally, the course is not aiming at formulating a precise answer to a given (realistic) task. It is much more oriented to offering students the opportunity to explore interdisciplinary work. The format of the final output is relatively open and can range from posters and physical models to films, and performances. It is presented at the last day of the workshop and is fully documented as a follow-up.

2 Boundary Conditions

Format of the case

Summer school at the HafenCity University Hamburg (HCU), master level, 10 days, 5 credits (= 150 hours, this includes preparatory tasks as well as a short reflection and documentation after the summer school)

Group of participants

60-70 MA-students and selected BA-students; Disciplines: architecture, civil and structural engineering, urban design, urban planning.

International Partners

- Aalto University, Helsinki, Finland
- Chalmers University of Technology, Gothenburg, Sweden
- Royal Academy of Fine Arts, Copenhagen, Denmark
- Technical University of Denmark, Copenhagen, Denmark
- Gdansk University of Technology, Gdansk, Poland
- Tallinn University of Technology, Tallinn, Estonia
- Saint Petersburg State University of Architecture and Civil Engineering, Saint Petersburg, Russia
- ITMO University, Saint Petersburg, Russia

3 Interdisciplinary Character of the Case

The main aim of this case is to explore interdisciplinarity. Initially, interdisciplinary work requires prerequisites for the successful illumination of the interface. For understanding each another, a common language is essential. Partners need to respect each other as well as have interests that lead to knowledge and understanding. Most important for any kind of successful collaboration is the empathy not only for one’s own challenges, but even more so, for those of the others.

The B.I.S.S. partners are convinced, however, that it is no longer sufficient to promote the dialogue at the intersections of the disciplines, but that the impacts on the disciplines themselves must be illuminated. Through interdisciplinarity, own disciplinary approaches and methods will be transformed and be better streamlined. The B.I.S.S. as well as the project BeInterBaltic seeks to exactly spotlight the impact on the disciplines.

Having this in mind, during the B.I.S.S. the aim is to create an atmosphere in which every discipline was equally challenged and appreciated at the same time.

The challenge for each discipline was achieved by a solid group structure, which would allow only one discipline (and nation) in one group — meaning that one or at maximum two participants were the only person or people representing their discipline within their group — just as it happens in our professional working environment.
Additionally each student group is supervised by a mentors’ couple, and they themselves are from different disciplines and universities using different research and teaching methods.

4 Methods and Tools

Role of the teacher(s)
As already mentioned, no teacher is involved. The private planning office moderates the discussion.

Methods

LECTURES (EXPERT LECTURES):

KEYNOTE LECTURES: held by highly respected representatives (scientific experts, practicing engineers, architects, planners, artists,...) of the involved disciplines. The keynote lectures take place three times during the workshop — in the evenings.

“FOOD FOR THE DAY LECTURES” are short lectures in the context of the theme and explore different aspects from different disciplines of the overall topic. Thus they have the role of eye-openers and sources of inspirations. These lectures serve also from a social aspect as a common start into the day. To support the appearance on time at 8.90am coffee and cookies are offered. The “food for the day” lectures also allow linking the B.I.S.S. to experts from the participating universities who have not been included in the partner network yet.

SUPERVISION

MENTORS ROLE: Most crucial to the success is the mentoring system as the central element of our collaborative teaching strategy. Early stage researchers, teachers or practicing planners from the partner universities become mentors for the project teams. With the mentors a continuous supervision concerning methodological, thematic and organizational issues is established for the students. The mentors also enrich the project with their own methods and disciplines; like the students, they represent the different disciplines of the built environment, such as Urban Planning, Urban Design and Architecture as well as Civil and Structural Engineering or Environmental Engineering. By blending their approaches with the ideas of the students, new ways of working develop. In addition, external experts give individual input and critique on every project. This interdisciplinary concept helped to make the B.I.S.S. through all the 4 years a great success. Up to three groups are supervised by a mentors’ couple which has in advance elaborated and prepared their personal approach to the overall yearly topic of the workshop.

MENTORS CONSULTATION (meet the other mentors): This format is introduced to offer the multifaceted expertise of the single mentors to all student groups. During the mentors consultation students can get feedback from any of the mentors according to their project-specific needs.

GROUP WORK

GROUP-FINDING METHODS: The first moments, e.g. the first days are most crucial for the success of the summer school. To achieve the aim of interdisciplinary and intercultural working scenery the group finding process is of higher importance for the success of the workshop. The group finding process is based initially on the individual personal experience made by students within the following two activities:

COOK A MEAL (Learning from Neil Thomas): the students are mixed in advance and divided in three different groups. Each of the groups is given a specific amount of food ingredients and they need to prepare a lunch course, e.g. salads, sandwiches or dessert for all the participants in a restricted timeslot of 45 minutes. This activity turned out to be a great ice-breaker.

EXCURSION / CITY WALKS: again, mixed on purpose in 6 different groups the students explore Hamburg while fulfilling a specific task, e.g. searching for pre-defined city-elements. Coming back they present their findings on a map and discuss them in the bigger round.

FIND YOUR MENTORS’ COUPLE: The group-finding process includes the choice of the mentors’ couples. During the introduction lecture the mentors’ couples present their subtopics and working methods. The group finding process is supported by a “wall” where students can indicate their interest in a specific subtopic represented by a mentor’s pair. Last but not least this process is finalized at the end of the first day by submitting their choice late in the evening.

DESIGN TEAM: the main design work is done in groups of three to four students. The big challenge is to get a solid group structure, which allows only one discipline (and nation) within a group — meaning that one or at maximum two participants would be the only person or two people representing their discipline within their group — just as it happens in our professional working environment.

INDIVIDUAL WORK

PREPARATORY TASKS (the students come prepared): this means that the students work in advance on the B.I.S.S. topic and on their working methods in a broader sense. Every single participant has to reflect on their personal creative practice in the individual disciplinary work as well as on city development and links in their hometown. The results have to be presented in two posters (one poster for each aspect) or, optionally for 2018, as a short video/film.

CRITIQUES

EXPERT CRITIQUES: experts give individual input and critique to every project. This happens in a formal way twice during the workshop in the format “Questions and Answers”. As the students present their work on the walls this is comparable with an interim presentation. Additionally for specific questions concerning the projects individual critiques were organized.
EXHIBITION: The final presentation takes place on the last day of the summer school. In the morning the students finalize their presentations (models, posters, films, …) and organize the setting. This exhibition allows showing the results to a larger audience, and ideally it is available for a specific time (one to three weeks after the end of the workshop). In this way the results of the B.I.S.S. become visible for the whole university (HCU) as well as for society.

SILENT PRESENTATION: officially the final presentation starts with a jury meeting. This is done as a silent presentation, meaning that the students are not present and their work needs to speak exclusively for itself through the form of presentation: for example by the used printed media, movable pictures or physical models and their arrangement. The members of the jury represent the different disciplines of the B.I.S.S. They are members of the participating university, representatives of the participating cities or experts in practice. Finally they point out the weak and strong points of the projects and make a ranking.

GALLEY CRITIQUE: After the jury has taken a common decision on the ranking of the projects, but before sharing it with the audience, the so-called “public jury round” takes place. Within this public round, the jury members give a general comment on the projects and on the way they were presented and interpreted by the jury. At this point, the students have the chance to interact and explain.

B.I.S.S. — POST-PROCESSING: in order to reflect on the results of the B.I.S.S., a post-processing process is organized after every edition of the summer school. Students and teachers summarize the projects, the methods used and the evaluated results. Additionally they reflect the workshop from a personal point of view. This allows for the further development of the format.

BOOK PUBLICATION: a written publication is a quite classical form of documentation which was chosen for the documentation of the first three B.I.S.S. This documentation includes the post-processing but also additional input from the mentors who write short articles on the topic from their point of view. Also the keynote speakers and some of the experts enrich the books with some additional expert input.

FILM: for the last B.I.S.S. a new form of documentation was chosen. Students of the study program “Culture of the Metropole” at the HCU, specialized in movie making and film documentation, “escorted” the workshop as well as the preparatory mentors’ workshop in Tallinn. They provided, in the form of two short documentaries, lively and immediate insights on the interdisciplinary work before and during the summer school. Besides the visual representation of the participants and the work process, the B.I.S.S. video documentary uses the “interview” as a main source of information on the format and outputs of the workshop.

Individual teaching format led by mentors

The mentors, working as a teaching couple, elaborate in advance a specific common subtopic. 2 to 3 student groups work under their supervision on the chosen subtopic, which in the same time is the playground where the scientific and methodological background of the mentors is combined. This makes each subtopic and each mentor’s approach to a unique teaching case. The B.I.S.S. mentors used throughout the three project years a large variety of methods and tools. The most commonly used ones are summed up here:

- Brainstorming
- Warm-ups in the group
- Reflection
- Games
- Discussion (group discussion)
- Exercise
- Data Collection
- Excursion: all forms
- Analysis
- Synthesis
- Practical hands on
- Zooming out
- Zooming in
- Iteration
- Story board
- Collage

Tools

WELCOME PACKAGE: A welcome cloth bag is given to each student at the registration. This includes among others the logbook, a city map and an USB-stick. As the logo was printed on the bag it served as an identification element during the workshop and as a memory afterwards.

LOGBOOK: the logbook contains all the necessary information about the structure, the schedule, the mentors and the subtopics of the B.I.S.S.

PRESENTATIONS OF THE MENTORS’ COUPLE: in the welcome session the mentors introduced themselves, their scientific interest and working methods. In addition to the presentation of the subtopics in the logbook this serves as a basis for the choice of the mentors’ couple.

“WALL”: to support the group finding process as well as the choice of mentors a “wall” was provided were students could announce in an informal way (by putting stickers with their names) their preferences.
Excursion / City Walks: serves as a warm up for the students and fosters the group finding process; it also offers the first interaction with the city and the specific site.

Cook a Meal (Learning from Neil Thomas): serves as a warm up for the students and fosters the group finding process.

Models: used as working models in the workshop for exploration of ideas and principles. Presentation models were prepared for the final presentation.

Video/Film: allows for the exploration of the context and serves as a work method or tool for an observational and to a greater extent subjective and abstract presentation of space, characters, processes and events.

Performance: used in the mentors groups for exploration. Occasionally a final output and then documented in a film / video.

Simulation / Software: used to explore principles, depending on the task and method.

Calculation: used to prove assumptions.

Drawing / Sketching: used in all phases of the workshop.

Digital Platform: particularly after the workshop the digital platform allows to keep in contact, exchange material and thus be an essential tool to strengthen the network.

5 Process and Implementation

5.1 Chronological development

The workshop starts with a preparatory phase. During this phase the thematic scope and the content of the workshop is prepared and developed by the organizers. At the same time, it also gives students the opportunity to prepare themselves for the interdisciplinary adventure.

5.2 Preliminary work

1. Setting of the topic: the partners decide approximately half a year earlier on the yearly overall topic of the workshop.

2. Mentors Preparatory Workshop: the mentors develop their own approach towards the overall topic. With this idea they match into pairs and elaborate into detail their approach.

3. Application: students apply at their home universities. They need to submit a short sketch on their motivation. An evaluation process is set up at each university.

4. Preparatory task: The students prepare posters or a film on their working methods and a specific task related to the yearly overall topic before their arrival to Hamburg.

5. Discover

5.1 Group finding process at the first day in Hamburg: during this process the diversity of the group is discovered as well as the potential of the city of Hamburg to generate and explore questions of the built environment.

6 Inputs: Keynotes and food for the day lectures serve as additional inputs.

6.1 Explore

7 Group work: the group work is done under the supervision of the mentors.

8 Experts critiques & mentors consultations: to sharpen the own ideas these need to be presented. This is done twice during the expert critiques as well as at the mentors’ consultation sessions.

9 Final presentation: on the last day the results are presented in a public exhibition.

6.2 Deliver

10 Post-Processing: each student and each student group need to sum up their project as well as their experiences during the B.I.S.S. Also the mentors individually and as a pair document their opinion on the students’ projects and personal benefit of the project.

11 Documentation: each workshop is finally and completely documented through a book or a film.

Development of the contents | Outputs
See Case Tree in: Page 105.

6 Reflection

Reflection on the teaching strategy | Methods | Tools

The used teaching methods and tools are generally well-known and not new at all. But in combination with the disciplinary background of the students as well as the ones of the mentors and the context of interdisciplinary and internationally mixed groups they were explored in a non-conventional way.

The main challenge was to mix the students from different culture and disciplinary background and to make them work together. The broad range of methods and tools offered by the mentors, the intensive supervision by mentors and experts, and the structured but also to some extent flexible schedule provided supportive environment to any idea or need that emerged out of the students’ work.

Reflection on the quality of the outcome

The quality of the project outcome was extremely good. The developed projects show a large variety of approaches, methods and topics. The high quality of the outcome is directly related to the intensive supervision and mentoring of the student groups. The quality of the outcome was confirmed through the international and interdisciplinary jury who reviewed and evaluated the results on the last day.

Reflection on the learning output

The final presentation and the following documentation reflect the high quality of the workshop. Due to the relatively high degree of interdisciplinarity and the extremely experimental character of the workshop the results are hardly comparable, instead the
jury pointed out the rich variety of approaches. Beside the scientific output the personal benefit was pointed out both by the students as well as by the mentors. These personal benefits include new perspectives and viewpoints but also dealing with conflicts and challenges like different languages.

Reflection on the interdisciplinarity
Through the firm group-finding process and the restrictions on the national and disciplinary mixture of the groups the essential basis for the group work was laid and an enthusiastic and vibrant atmosphere could be created. Generally there is a lack of engineers being interested in such a summer workshop – thus it would be desirable to integrate more engineering competence in the workshop. The whole workshop allows the students and mentors to test out different formats, methods and tools and prove their usefulness for the specific task. Additionally they have the possibility to transfer the experience to their own discipline and explore their effectiveness.

Comment on the case
The described teaching strategy requires a high input and engagement of all participants, students, mentors, experts and organizers. However, the overall experience shows the high benefits for everybody on all levels (educational, methodological, scientific, personal, etc.).

Comment on the communicative structure:
The communicative structure is clearly organized through the logbook and the mentors. The challenge of the course is to enable immediate adjustment to projects and ideas.
A teaching method is a systematic way of doing something. (Art of doing something in a systematic way). It implies an orderly logical arrangement of steps and is more procedural. It is a series of related and progressive acts performed by a teacher and students to achieve the object of the lesson.

The method is the manner in which you use the tools for teaching.

Technique (tool) — any of a wide variety of exercises, activities, or devices used for realizing lesson/course objectives. It must be consistent with "a method" and in harmony with a strategy. Art of performance.

1. In general, a method is more than a tool.
2. Depending on the complexity of the task, a tool can be a method.
3. The same tool can be used for and within different methods

The here presented definitions of methods and tools are based on the joint evaluation of the case studies from the previous chapter. Through the continuous methodological discourse within the three years of the BeInterBaltic project a common methodological language for teaching in interdisciplinary context could be created. This "common language" should be seen as the tool for knowledge transfer between the disciplines.

The authors of this document are aware that the following listed definitions can have a broader meaning when considered in other contexts.

Compare: http://www.oxforddictionaries.com/definition/english/method


Register

ANALYSIS (↔ SYNTHESIS)
Processing data/information/facts/activities/experiences/processes and finding meaningful relationships and patterns to target results within appropriate theories and frameworks.

SIMULATION
An attempt or trial to provide possible solutions, which could/should be developed and tested throughout the design process.

STORY TELLING
A qualitative research method based on analysis of narratives given by the members of a particular group of people (team, community, society).

ANALYTICAL DRAWING/ SKETCHING
A graphic representation or notion of the space; in the case of sketching it implies immediate performance.

ANALYTICAL READING
Collecting facts from different types of written sources (articles, books, regulations, community documents, etc.).

PERSONA BUILDING (see definition of case)
Tool widely used in user-centered design; a way to model, summarize, and communicate research about the different user types; the process considers not only basic characteristics but also behavior patterns, goals, skills, attitudes (Dorota).

VALUE PROPOSITION CANVAS (see definition of case)
Tool helping to define value proposition in a more structured and reflective way; this tool is a part of Business Model Canvas (a strategic management and lean start-up template for developing new or documenting existing business models), which helps to design products and services to answer users' needs.

BRAINSTORMING (↔ REFLECTION)
A mental activity for generating new ideas and solutions. Some characteristics: quick, fast, no hierarchy, no order.

LOTUS BLOSSOM TECHNIQUE
A specific form of brainstorming applied in Case XX (Dorota).

CONTEXTUALIZATION (↔ REFLECTION)
A general approach which uses different tools for gathering objectives or experiential data in order to give context to the questions/tasks to be addressed. This includes methods of data collection, experience and excursion.

DATA COLLECTION ↔ EXPERIENCE
A targeted process of gathering selected quantitative or qualitative material (figures/information/facts/activities/process/results) by using specific approaches.

DATA COLLECTION
Is intended to be objective and includes interviews (with locals, experts, stakeholders), literature review (case study), references (built examples), recordings, measurements, mapping, etc.

EXPERIENCE ↔ DATA COLLECTION
A targeted process of gathering experiential material using specific approaches based on individual perception and experiences. It includes among others filmmaking, explorative sketching, painting, collage, role-play, poetry writing, etc.

EXPLORATIVE SKETCHING
A method of repetitive drawing in order to reach a level of abstraction that unfolds the essence of a complex issue.

DRAWING
The practical, multi-sensual analysis of visible elements; manual activity with multisensory experience.

COLLAGE
A composition made out of different materials, new or reused, with the aim to present or explain a certain reality. For example it could be a collage presenting a site, an idea or a design concept, etc.

ROLE-PLAY / EXCHANGE OF ROLES
A targeted process of learning about other than own perspectives (opinions, responsibilities, needs, etc.) and broadening the field of exploration by empathizing, i.e.: to understand the behavioral aspects of a third body.

EXCURSION
A method of gathering experiences and data by confronting the participants with the environment, in order to study the physical space. This is a method that requires a careful observation, immersion in the reality evoking personal sensation and experience of the materiality of the space. It includes: on-site visit, observation, walking tour, field trips, boat trip, bus/train tour, etc.

ON-SITE VISIT
Excursion combined with the exploration of the site.

OBSERVATION
Excursion focused on studying specific aspects.

WALKING TOUR
Excursion based on walking with focus on the perceptual aspects of the space (e.g.: Sound walk).

FIELD TRIPS
Excursion based on walking in order to confront with the interventions in the space.
CRITIQUE
A critique points out the strengths and weaknesses of a project. Generally, a critique is part of presentation (see also 12.Presentation).

TABLE CRITIQUE
A more informal critique performed around a desk, without the participation of the whole class or external audience.

SUPERVISION
Careful consecutive guiding through the process of learning and design, carried out by more experienced students, experts and/or teachers during the process of work development.

CONSULTATION
Provision of qualified feedback by experts or teachers to a specific issue or a project stage.

PEER-REVIEWING / CROSS-CRITICS
Evaluation/critique given by the peer-group (students to students).

DESIGN THINKING
Constant interaction (oscillation) between the definition and understanding of the task and the development of possible solutions in a creative and multidisciplinary way.

DISCUSSION
The process of communicating within the group in order to explore questions, exchange ideas and/or reach a (common) decision.

PLENARY DISCUSSION
A discussion between few experts in front of a larger audience. Generally the plenary discussion is moderated.

PUBLIC DISCUSSION
A discussion that is carried out beyond a professional community and includes participants from the general public.

DEBATE
A type of a discussion where different viewpoints are being argued. Its aim is to raise awareness of the fact that there are many viewpoints and one need to allow for a balanced/democratic exchange of ideas. Debates often have a more structured format, compared to an ordinary discussion.

DOCUMENTATION
A process which provides processed and organized evidence of selected data/information/facts/activities/process/results in an objective or subjective way. Examples of documentation include: drawing, film, poster, project, report, exhibition (content of the boards), mapping, portfolio, essay, model, visualization (rendering), photo, power-point, recording/diary, etc.

EXERCISE (↔ PROJECT)
An exercise, typically, is small task, performed in a short time. It is much less complex than a project. It addresses a narrow question, which is precisely defined. Often it is planned in the way that the output is controlled. An exercise addresses a single or few aspects that are investigated/dealt with a specific purpose.

GAMES
A group activity which allows for the investigation of a topic from a different perspective through exploration of rules and relationships.

GROUP WORK (↔ INDIVIDUAL WORK)
A collaborative interaction of a smaller number of people aiming at exploring, analyzing, synthetizing, etc. a specified issue.

TASK FORCE TEAM
A number of groups work together on a complex context subdivided into subfields which are explored independently. The work in a task force team is primarily analytical.

DESIGN TEAM
Group work which is primarily explorative and synthetic. If the team consists of members from different disciplines it is called an interdisciplinary design team.

GROUP FINDING
Small tasks and exercises to foster/support the formation of a work group. Especially required when participants meet/come together for the first time.

INDIVIDUAL WORK (↔ GROUP WORK)
An activity in which the individual takes responsibility for the planning and implementation of the given task.

ITERATION
A method of managing a complex question or task, in a structured manner, in order to organize design decisions at different stages of the design process. Characterized by a repetitive/iterative/recursive process where a successively growing understanding of the question or task and how to achieve desired qualities are gained.
**LECTURE**

A one-way communication of structured information from one person (or a small number of people) to a larger audience.

An **INPUT LECTURE** is a lecture that initiates, motivates and frames a process.

An **EXPERT LECTURE** is a lecture that provides knowledge on a specific topic.

**PRESENTATION**

Communication of work results from the presenter to the audience.

There are different forms of presentation: exhibition, silent presentation, gallery critique, pecha kucha, performance, etc.

**EXHIBITION**

A display of works accessible to the public audience.

**SILENT PRESENTATION**

A specific type of presentation aimed at a jury, where models, drawing and other media are presented in a self-explaining manner.

**GALLERY CRITIQUE**

A specific type of presentation with critique where the participants pin up drawings, present models and other materials to the critic/s and the rest of the participants in the group. (see also 11.Critique)

**PECHA KUCHA**

A specific type of image presentation which consists of 20 images displayed for 20 seconds each. This format keeps presentations concise and fast-paced.

**PERFORMANCE**

Can be a presentation in a form of event (i.e. concert, play) evoking different experiences by activating the senses of the audience through using different media and temporal displays.

Depending on the time of the presentation there can be three kinds of presentation: KICK-OFF, INTERIM OR FINAL.

A **KICK-OFF PRESENTATION** is done at the very start of the project development, while an **INTERIM PRESENTATION** is held during the duration of the project. A **FINAL PRESENTATION** is a presentation and a review/critique done at the end of the project.

Based on the number of people presenting: INDIVIDUAL OR GROUP presentation.

**PRACTICAL HANDS-ON (EXPERIMENT / MONITORING / PROTOTYPE)**

Exploring properties, characteristics or phenomena through practical hands-on, including testing in a digital environment.

This method includes: experiment, testing, monitoring, prototyping, digital model, physical model: material model, sound model, small scale, large scale, 3d-Printing, ugly model (fast, rough, concept), lab-testing, experiment, modelling, model 1:1, Computer tool pointSketch (own development), Computer tool ForcePAD, Computer tool Equilibrium (ETH)

**VARIATION**

The extent to which or the range in which a parameter/element/object differs in specific conditions.

Examples: **PARAMETRIC VARIATION**, **GEOMETRIC TRANSFORMATION**

**PROJECT (↔ EXERCISE)**

A planned set of complex interrelated tasks aimed at solving a (design) problem or answering a question which are to be executed over a fixed period of time and within a defined context. It is opposed to an exercise with the level of complexity that it addresses.

**REFLECTION (↔ BRAINSTORMING)**

A mental activity for analysis and pattern recognition of outcomes or processes. A diary for example is a daily reflection of activities and decisions made.

Some characteristics: evaluation, critical approach, retrospective.

**SEMINAR**

A chaired, dialogue-oriented and interactive teaching setting focused on a topic. Some characteristics: participative, interactive.

**SYNTHESIS (↔ ANALYSIS)**

A meaningful fusion of processed data / information / facts / activities / experiences / processes / results leading to conclusive answers or guidelines.

Characteristics: evaluation for decision-making

**STORY BOARD**

A tool used to display thinking process as a sequence; Different forms of representation: illustrations, texts, images, performances, films, etc. (Dorota, Lotte)

**SELF-CREATED TEXTBOOK**

A special form of a story board that summarizes the content of a whole teaching course. The course material gets reorganized, reflected and synthesized into a coherent story. (Karl-Gunnar)
WORKSHOP
An experimental setting of people and tasks with a highly focused work atmosphere and within a specific time-frame.

ZOOMING IN / DETAILING / SCALING (↔ GENERALISATION)
A process of creating picture/state showing more informative aspects of the object, increasing the level of details by incorporating complexity.

ZOOMING OUT / GENERALIZATION / ABSTRACTION (↔ ZOOMING IN)
A process of creating overall (general, abstract) picture/state showing the interaction of intended elements with the aim to reduce complexity.

Examples from cases:
Creating theoretical models, graphic statics, rules of thumb, typologies, patterns, language and definitions (sometimes different interpretations for different purposes), computer tool pointSketch (own developer), computer tool ForcePAD, computer tool equilibrium (ETH)