

If we Know where we are Going, there is No Need to Go.

First I will tell three short stories that reflect present and future demands for innovation:

Story One



*Exercise II
If we know where we are going
there is no need to go*

Some years ago I attended a lecture given by the Danish philosopher Casper Nefer Olsen. The lecture reflected the differences between law and architecture. The main argument of the lecture was that where law in its fundament is based on match, architecture is based on the absences of match. Casper Nefer Olsen presented his argument with the example of a criminal who has become a criminal through the act of a crime. In order to punish the criminal, he (or nowadays it might be a she) is prosecuted. Through the procedure of the court case it is the work of the prosecutor to find a specific paragraph in the law that matches the criminal act. The point is that when a match is found the criminal can be sentenced and the work of the court is done; law works on the principle of match between the criminal act and the law text. Architecture, on the other hand, works on the opposite principle; the principle of no mach. If there is a match, there is no new architecture. Ever since the *Ten books on architecture* by Vitruvius, the field of architecture has constantly expanded due to this principle. Every true renewer has in the beginning stepped outside what was at the given time considered as the limit of architecture. Only after a long time and often with terrible struggles, what was at the beginning not considered to be architecture is slowly accepted and assimilated within the new boundaries of architecture.

In other words, story one emphasizes the importance of innovation in the field of architecture.

Story Two

Recently I overheard a conversation between some members of the Danish National Patent and Trademark Office. Through their conversation it became evident that the office currently receives a large number of applications for new patents. Among these applications a large majority (more than 95%) fell under the category of further development to already existing patents. Only a minor part of the applications fell into the category of *true* inventions or *never before seen* inventions. This shows in clear numbers the difficulties involved in creating something that from the beginning does not belong to a certain typology nor have an already known image; thinking the unthinkable, - or crossing the bounds of our

own imagination - is a difficult task to undertake. It does, however, make it more important than ever.

More and more industries have understood the writing on the wall. Research and development have become today's mantra in the struggle for survival in a forever more competitive world. Without innovation the days may be numbered for any modern industry; this applies to industries in general, and to the building industry in particular.

Seen from a distance this might seem as old news taking into consideration that the industrial revolution as well as today's information technology society have been carried on the wings of development and innovation. To be ahead of your competitors by means of new inventions has always been the trademark of success. The new news of today are, however, the speed with which the development of new inventions is done. This has to an almost extreme degree pushed forward a demand for people with an innovative way of thinking.

At the last EAAE-ENHSA Workshop of Construction in Lyon we discussed various teaching methods as well as their possibilities and limitations. One of these methods being the "classical" study of the great masters caused a series of comments and reflections. On one hand it was evident that this method had numerous qualities. Not only did the students learn the secrets and tricks of the old masters in a very quick way, but the whole idea of learning by copying seemed efficient in itself. On the other hand the method seemed to carry its own limitations that became obvious by posing the question, "Where did the masters go to learn?" Or in other words; the method left the students at the doorstep of the masters without giving them the tools to pass beyond the masters. Therefore it became obvious that copying as a teaching method has its own limitations, and to pass beyond these limitations a method of a more innovative character has to be employed.

With the three stories at the back of our minds, it needs no further explanation that the ability to master an innovative process is one of the most needed and acquired competences in the profile of the future architect. This applies for the profile in general as well as for the competence in the field of construction in particular.

Naturally a series of other competences are essential to fulfil the profile of the future architect. Among these is the ability to identify, analyze and persistently pursue the architectural problem of the greatest importance. Especially in the situation of today where the architectural agenda changes rapidly. The young architect must be able to manoeuvre safely under these circumstances. This calls for the competence of being able to change architectural strategy rapidly as the architectural problem alters.

Yet another competence that needs to be mentioned is the ability to work in teams. With the increasing complexity of the building process, it becomes more and more evident that the traditional architect with the overall view is being replaced by a team of decision-makers. This calls for the

Story Three

Mastering an Innovative Process, - a Future Competence of the Candidate.

competence of being able to work in teams, and in this relation the ability to identify personal resources and competences, and to bring these into play in teamworks.

Innovate Don't Imitate

The next question is how? How do we meet the above-mentioned needs for specific competences in the profile of the future architect after graduation, and which educational methods and pedagogic strategies does this require? The simple answer to these questions is of course that the students in their architectural training must *work in teams, using a process oriented method to solve architectural problems in an innovative way*. Put in other words; *if we know where we are going there is no need to go*. This answer, however short it may be, I think is right. At the same time it is a simplification of a reality that is far more complex than the answer signifies. The point here is of course that there are no infinite or normative answers to the question. The answer must always be addressed relatively because the question of "how?" will always vary according to the existing architectural realities. This is in my opinion one of the worst "traps" that must be avoided when trying to give a simple and ultimate answer to a complex question.

Again Sisyfos' stone rolls back in the pit and leaves us with the question of "how to teach construction" and "what pedagogic method to use".

I believe the best answer derives from empiric experiences in teaching; from demonstrating and sharing our pedagogic methods and aims; their possibilities and limits, successes and failures. Openness as well as self-criticism and criticism from others are in this process the only efficient tools that can improve the teaching methods in construction. The process is long and never-ending, only one thing is for sure; it is process oriented and innovative.

Go Shopping

The second EAAE-EHNSA Workshop of Construction Teachers' Sub-network in Lyon facilitated the above-mentioned possibilities. The different schools and universities of architecture presented examples of their own teaching methods. This gave a fantastic opportunity to share experiences and to "go shopping" among the presented work. Karl Christiansen and I from the Aarhus School of Architecture, Denmark, certainly took this opportunity to "go shopping" and be inspired by the presented work. As a result we tested some of the demonstrated methods and exercises when we came home. This has been the point of departure for testing and developing new ideas for exercises. As an act of gratitude we would like to present an example of some of our recent teaching exercises. This work emphasizes teamwork, innovation and the ability to work process-oriented.

One Example

At the Aarhus School of Architecture a workshop was held in 2003 with the aim of examining the architectural potentials of concrete as building material. The point of departure was teamwork between the school of architecture and a number of enterprises and companies within the Danish concrete industry. In the following text the experiences from this workshop are being resumed and evaluated: first of all the experiences

accumulated from the pedagogic aim of stimulating the students' innovative competences; secondly, the experiences from a teamwork between a state institution and private enterprises, - sweet music to the ears of the present government's education policies.

It has been said repeatedly to the schools of architecture in Denmark that the architectural education has become too academic. That the education focuses on theoretic and historic matters and gives less attention to the actual practice of architecture. It has also been said that the education is out of touch with the demands on the future architect as well as on the development of society in general.

The criticism has been raised from several sides simultaneously; from the private sector in general and the building industry and the political establishment in particular.

This is not an attempt to dismiss the criticism as this has unfortunately often proved to be right. On the contrary; the wish is to point out that attention is given to the criticism and based on this initiatives are being taken with the purpose of breaking down the barriers between education and practice.

Cooperation and teamwork between a state institution of education and private enterprises are not a new constellation in itself; and certainly not where a school of architecture is involved. In fact this constellation has often proved to be the rule more than the exception; with the cooperation between the Bauhaus school and the German steel industry as a splendid example. In that respect there is nothing new under the sun when the Aarhus School of Architecture cooperates with a number of private enterprises. The interesting thing is to evaluate today's state of teamwork and to ask the question how it is possible to establish a teamwork that benefits both parts.

The main participants in the workshop were forty architecture students, five teachers and four enterprises.

The workshop was divided into two phases corresponding to different casting techniques in concrete.

In the first phase the task for the students was to develop and plan a method for casting concrete in an elastic form. The students were in groups of four given two rubber tubes, with the dimensions 200 x 1200mm, which were to be filled with white concrete.

From a starting point this was an impossible task to perform as the rubber will only expand according to the quantity of concrete being poured into the tube, exactly like a balloon filled with water will expand due to the pressure inside. However, this paradox was one of the pedagogic aims of the exercise; to give the students an intuitive understanding of concrete as phenomenon. Or in simple words; through their own practise to let them see how concrete transforms from a heavy liquid to a heavy solid and in this process changes its pressure on the sides of the form. These are experiences that in a professional perspective exist as common sense and therefore may seem like trivialities, but for the students these are essential in order to be able to exploit the full potential of the material.

Exercise I



*Exercise I,
Casting Concrete
Objects*



*Exercise I,
Unwrapping Concrete
Object*



*Exercise I,
Tectonic Integrity*



*Exercise I,
Tectonic Integrity, detail*

The most important pedagogic aim of the exercise was, however, to stimulate an innovative working process. An aim that could be resumed in the question of how to cross the limits for one's own imagination and be able to create without a predefined image or goal? Not an easy task to undertake as architecture students are in general trained to find solutions to architectural problems by using their imagination. We wanted them to do the opposite; to find solutions without using their imagination but through a predefined working method. It was therefore a standing 'modus operandi' that *if they knew where they were going we would ask them not to go.*

The pedagogic strategy was emphasized by the way of casting concrete. In the traditional way of casting concrete a stable and non-elastic form is used. This has as a consequence that the result of the casting process is known on beforehand. Or in other words; through the design of the form the design of the concrete object is known. The consequence of this is that no sudden surprises occur during the casting process (unless something goes wrong) that could be a point of departure for new investigations of the potential of concrete. In other words, you get what you expect, no more and no less. When concrete is cast in an elastic form, the opposite situation exists. Suddenly a diversity of possibilities occurs as nothing is predefined from the beginning. This gives rise to a tremendous (endless) amount of developing potentials. For the students this way of working with concrete was both very inspiring and frustrating. Frustrating because the images that they unconsciously and by habit created were of no use, as only the process carried the result. Inspiring because they discovered new potentials in concrete that were beyond their imagination. In other words, they were tricked through the exercise to cross the limits of their own imagination. This was a truly challenging moment.

Finally it was a pedagogic aim of the exercise to emphasize how the process of casting concrete leaves its own and unique footprints in the cast object. In this way it becomes one of the aesthetic qualities of concrete to tell the story of how it was conceived through its own process. The finished concrete object tells its own story. This pedagogic aim was actualised through the exercise in the way that the student, in order to withhold the pressure of the concrete in the elastic form, constantly had to use different tools and items to keep the form in place. To maintain the column of liquid concrete through this dynamic process, they used strings, metal bands, heavy rocks, various pieces of wood, etc.; all were the kinds of materials that in their specific way left marks and traces in the concrete and in this way told the story of how the concrete objects were formed.

Exercise II

In the second phase of the workshop the task for the students was to design a larger column/beam construction that was to be placed in the context of the main entrance of the school. The construction was to be cast as a traditional pre-fabricated construction using plywood as the form material.

The pedagogic aim of this exercise was primarily to focus on the complexity involved in the solution of an architectural problem of today. This expressed explicit in teamwork and cooperation that is necessary between

different groups of professionals. As so, the exercise represented a simulation close to reality.

The students were in groups of five asked to design a separate part of the construction (column, beam, foundation block). This had to be done in consideration of the overall design of the construction. Already at this stage an immediate urge for communication between the different groups emerged as even small changes in the design of one component resulted in the necessity of negotiations with the "neighbouring groups". As a direct consequence this necessitated an open and dynamic design process.

In addition to the need for communication the design process was strongly influenced by static and constructive demands made by the engineers. At the same time the designs had to be adjusted in accordance with the production techniques, and for that reason had to be discussed with the involved companies.



*Exercise II
Design Process*



*Exercise II
Making the Mold*



*Exercise II
Making the Mold, detail*



*Exercise II
Making the Mold, detail*



*Exercise II
Preparing the Steel Reinforcement*



*Exercise II
Casting the Molds*



*Exercise II
Unwrapping the Objects*



*Exercise II
Montage*



*Exercise II
The Structure*



*Exercise II
The Structure, detail*

As if this was not enough, yet another set of design parameters were introduced emerging from the fact that the students had to design, construct and build the necessary forms on their own. Finally, it was a design parameter that the separate parts of the construction had to be adjusted in accordance with the facilities for transportation and assemblage. All this had to be done with a timeframe of altogether 19 days.

They succeeded, but only just, within the set time limit. The success was a result of a tremendous tour de force, an excellent teamwork and not forgetting the extended use of IT-tools which enabled the students to embrace the whole design process. In the initiating design process Form-Z was used as the design tool whereas AutoCad was used in the final stages of the process. Without these design tools it would have been impossible to carry out the exercise within the set timetable.

Conclusion

Let it be said from the beginning and without any secrets; it was very difficult to catch the attention of the students to the theme of the workshop - concrete. Perhaps we should have foreseen this lack of interest, as the prejudice against the material obviously exists as widespread among architecture students as within the general population. The result was that the workshop started uphill from the beginning. It also gave us the first signs that in order to make the workshop a success we had to approach the subject in an unusual and unconventional way. This led to the decision to study and examine concrete in a very direct and intuitive manner. As a consequence the students were in the first phase of the workshop asked to cast concrete in elastic rubber tubes. This gave them an intuitive understanding of the specific limits and potentials of the material as it gave them a broader knowledge of the material as phenomenon.

With the experience from the first phase of the workshop it was the pedagogic aim of the second phase to focus on the complexity of teamwork in the professional world of today; this was done through the design of a larger construction in prefabricated concrete. In addition to this aim the wish was to give the students the experience of going through a full architectural process from beginning to end; from the primarily freehand sketches, through the adjustments of the design due to the various design parameters, to the real making of the forms, and finally to the inauguration of the construction. An experience that is only rarely possible to give the students because of economical and practical reasons. This is unfortunate, one may say, because it is the only kind of experience that can fully open the eyes of the students to an understanding of the integrity of the architectural process.

As a conclusion to this phase of the workshop it must be said that the students were fully confronted with the complexity of today's teamwork. The large number of design parameters that were brought into play forced the students to keep the design process open and dynamic. In the beginning this brought about a number of discussions and negotiations between the groups as well as within the individual groups; discussions that in many ways paralysed the design process. As a result the designs were constantly redesigned, and with a deadline that was rapidly approaching these disagreements became a valuable source for finding architectural solutions. This was perhaps one of the most valuable experiences of the workshop as the students discovered the possibilities in a problem that from the beginning seemed impossible to solve.

The big and open question of the workshop was of course how cooperation between a state institution and a number of private enterprises would work out. We on our side had our doubts, especially concerning the question of whether or not we would have free hands in the planning and definition of the aim of the exercises involved in the workshop. We were totally mistaken and our doubts were put to shame. Not on any occasions did we have our hands tied or feel any restraints. Of course this does not imply that the involved companies had no intentions or hidden agendas; of course they did. We were fully aware that when a company places their expertise at our disposal together with a larger sum of money, this does not take place for the sake of our blue eyes or without any payoff. Naturally the agenda for the companies was to introduce concrete as a building material and demonstrate its potentials to future architects. Of course, you can say, it has to be like that. The positive side was, however, and that is the point, that at no point in time was the agenda of the companies hidden, - or at least we did not find out. We were at no point in doubt about what they wanted and they were in no doubt about what we wanted. We needed professional expertise and the possibility of producing objects of a larger scale, and last but not least; we needed a financial sponsorship. They on their side wanted to demonstrate their expertise and products, and at the same time advertise for them-selves. Finally both parties had an interest in cooperation out of sheer nosiness; this was in fact the real secret of the success of the workshop.



Stop making sense