International Concrete Design Competition for Students 2003/2004 – ROBUSTNESS

CONCRETE DESIGN BOOK ON
ROBUSTNESS

CC001
TC120
DK021
SO124

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ROBUSTNESS
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CONCRETE DESIGN ...

SIEBE BAKKER, EDITOR / CONSULTANT

The Concrete Design Book on Robustness is the culmination of the Concrete Design Competition 2003/2004 – ROBUSTNESS. It's a rather ambiguous title for an initiative that reaches far beyond its implied nature. The competition itself, the centrepiece of our ambitions, was the starting point for an ongoing exploration of 'robustness' and its implications for concrete in architecture.

The competition did not call for an architectural design or solution to a given condition. Rather, it asked participants to explore and exploit notions of robustness as a fundamental property of the material concrete. It asked them to test and present these ideas via a proposed architectural use. We received a wide variety of seemingly traditional proposals ranging from furniture to large-scale urban installations were submitted in the end. However, a range of new and exiting ideas on how to 'bring out' the robust nature of concrete, and on how this inherent property can enhance any given assignment: that was what we set out to achieve. Michael Speaks, curator for the 2003/2004 edition, introduced another interpretation of robustness to the competition when he defined it as an extra layer concerning design practice on a general level. Here, robustness indicates an approach to design that is more exploratory by nature than geared to 'problem solving'. The combination of an apparently familiar and robust material like concrete with a robust and exploratory attitude to design and building truly calls for 'Design Intelligence', a notion introduced by Michael Speaks while investigating current shifts in design practices around the world.

345 Students studying in eight European countries – and representing many more nationalities – submitted a total of 245 competition entries. In the first round national juries scrutinized the entries and selected three nominees or winners that were then forwarded to an international competition platform. A total of 24 entries were thus presented to an international panel of acclaimed architects and engineers in the final round. In addition, the makers of the final 24 entries were invited to take part in the next stage of the 'competition'. They came together in August 2004 for a crash course in robust design practice. The Concrete Design Master

Class on Robustness, led by Michael Speaks, continued a very specific investigation into material – concrete – and design.

In an intensive six-day exercise in extensive material research combined with experimentation into production techniques, participants explored the possibilities of making objects in concrete shaped by computer-manufactured 3D moulds. Gathering basic information about a variety of types of concrete as well as learning how to use specialized software was just the beginning. Adapting to a totally new design approach involving rapid prototyping made the master class a scary and confusing experience for many. The goal of the six-day master class was to produce a series of prototypes at full scale! And even though the actual execution of the final concrete objects was done in the months after the master class, the production companies had to depart with crystal-clear instructions on what to make.

Finally, though in one sense it marks the conclusion of the 2003/2004 edition, the Concrete Design Book on Robustness aims to provoke continued exploration of the general theme. Besides presenting the 24 winning entries and documenting the events and results of the master class, the book contains more reflective contributions that explore our ambitions. In a series of seven interviews, seven prominent professionals from the design profession give their views on the topics under discussion. The interviews offer us insight into contemporary design practice and education. Fundamental to both is the need to use knowledge, skills, opportunities and materials intelligently.

The International Concrete Design Competition for Students was initiated by the national associations of cement and concrete industries in the participating countries. The project is supported and facilitated by a range of companies, schools and individuals. All partners and contributors are listed on the final pages of this book.

CONCRETE DESIGN COMPETITION 2003/2004 ROBUSTNESS — BRIEF

MICHAEL SPEAKS, CURATOR

ROBUSTNESS: ro·bust \ adjective [Latin, robustus, oaken, hard, strong; French, robor, robur, oak, strength; perhaps akin to the Latin, ruber, red]. 1a: Having or exhibiting strength or vigorous health: powerful, muscular, vigorous; b: firm and assured in purpose, opinion, outlook; c: exceptionally sound, flourishing; d: strongly formed or constructed, sturdy; 2: Rough, rude; 3: requiring strength or vigor; 4: Full-bodied, strong, as in coffee or wine quotation from Webster's Third International Dictionary of the English Language

As indicated in the definition above, there are qualities associated with ROBUSTNESS, such as strength and solidity, which are also the qualities of concrete. Used to lay foundations, to build sturdy bridges and muscular, architectural monuments, concrete, even in its most conventional use, is an undeniably robust material. There are other qualities associated with ROBUSTNESS, however, not conventionally associated with the sturdiness of concrete. Due to the growing importance of complex, adaptive behaviour in all areas of scientific enquiry, ROBUSTNESS has also come to define the degree to which living things, whether single cell organisms, flocks of migratory birds, or complex social systems like ant colonies or metropolises like Tokyo or Mexico City, adapt to changing environmental conditions and evolve over time. ROBUSTNESS, in these contexts, defines a new kind of strength and solidity based on flexibility rather than inflexibility, on suppleness rather than stiffness, on resilience rather than rigidity, and it is this new strength that the competition seeks to explore in/with/through the use of concrete. Specifically, the competition seeks proposals that explore and exploit concrete's more conventionally robust qualities to create unconventionally robust designs whose flexibility, suppleness and resilience make them more adaptable, and therefore more durable, sustainable, hardy and long lasting.

In this inaugural competition students are asked to submit architectural proposals that engender ROBUSTNESS in/with/through concrete. In order to encourage the most diverse and original designs possible, no predetermined design criteria will be given or stipulated. Submissions are not limited to any scale and can range from small architectural detail, to interior, to free-standing building to landscape proposals. It is expected, however, that all proposals rigorously examine and make use of the manifest and latent qualities of concrete often hidden from view by conventional thinking and normal application. Competition entries will not be judged by stylistic, programmatic, typological, formal or other architecture design criteria*, but rather according to the innovative use of concrete to achieve a high degree of design excellence.

INTERNATIONAL JURY COMMENTS CURATOR'S SUMMARY

MICHAEL SPEAKS, CURATOR / JURY CHAIRMAN

Both national and international juries agreed that the competition brief was ambitious and offered a unique opportunity for an industry-sponsored educational initiative. Robustness, the juries also concluded, seemed to provide a strong conceptual framework for developing innovative uses of concrete through material research and product application.

The international jury, which consisted of members from each of the concrete consortium member countries – Turkey, Germany, Portugal, Belgium, The Netherlands, Ireland, United Kingdom, and Sweden – met in April 2004 to judge three entries from each of these eight countries. After three rounds of intense conversation and debate, the jury selected two winners and two honourable mentions from the twenty-four entries. While all jury members ultimately agreed on the winners, there were a number of other entries that the jury thought deserved mention in the commentary. Before moving on to the summary jury comments on the winners and honourable and special mentions, it is worth noting some of the general comments about all the entries.

Among the weaker entries were those that appeared to be adaptations of previous studio projects to the competition brief. This is not a good approach to a competition. In rare cases this occurred by simply adding the word 'robustness' to the boards. Even in cases where the work seemed of sufficiently high quality – owing no doubt to work previously completed – these entries rarely addressed the issue of 'robustness' in any meaningful way. It was also observed by several jury members that the larger-scale projects – especially those that attempted to address urban issues – were less successful than those that addressed smaller-scale issues. This was not simply a matter of scale; it was not the case, for example, that entries focusing on a single architectural detail or object were more successful. Often, in fact, they were not. Instead, the problem was one of not dealing with the brief. Had they done so, these urban-scale entries might have been encouraged to deal with the city as a robust system rather than treating it as a frame or context for design problems. By contrast, the most successful entries were those where new building systems, components or technologies

were introduced. Such systems could be deployed at any scale and were thus considered robust in-and-of-themselves. These entries were easier to discuss on their own merits relative to innovative uses of concrete to develop structural systems that were observably robust. The fact that several prominent structural engineers were members of the jury made such discussions – which included analysis and evaluation of the feasibility of the systems designed – among the more interesting that occurred during the day of judging. There were several entries in this category, however, that failed to make meaningful application of what otherwise was considered rigorous research and testing of concrete structural or component systems. In addition, there were a few entries that had clever or strong concepts that were not sufficiently developed or deployed. In such cases the entry seemed to simply stop after an initial – and in some cases quite successful – proposal. It is also worth observing that the jury was impressed by the relative strength of the entries from non-architectural, or rather non-specifically architectural design schools. This was especially evident in the quality of the presentation materials and the strong conceptual response each made to the brief. But it was also evident in the rigor of material research and documentation of the research and design process.

WINNERS

Rather than choosing one overall winner, the jury decided to award two overall winners, each with 2500 euro prize money. The jury moved through three rounds of discussions. The first round was a general discussion of all the entries resulting in seven moving to the second round. The second-round discussions focused on these entries and decided on four for the final discussion. In the third and final round two entries were selected as overall winners, not so much a compromise but in an effort to recognize two different approaches to the brief.

WINNER ONE

CC001

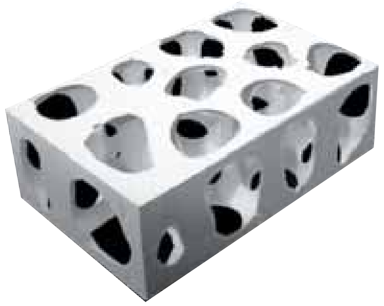
OPEN SOURCE
UK

The judges agreed unanimously that this was one of the two best entries of the competition. Unlike many entries, CC001 took very seriously the competition brief, elaborating and expanding it not only in their text but also throughout their presentation panels. The project title, Open Source, is borrowed from software developers who share code in an effort to make more robust operating and other forms of computer software. Code becomes more robust when the community participates by working out individual bugs or code design flaws openly and collectively. Accordingly, CC001 deals explicitly with the idea of community and also with how communities evolve and change over time, two issues at the heart of the definition of robustness offered in the brief. Most of the jury felt that this entry dealt better than any other with the brief. CC001 also develops a very strong material research and design proposal. Taking 'change-over-time' as its watchword, CC001 showed how concrete could be used to create environments that change according to different needs. A system of concrete tiles that change colour to signal different uses during the week, month and year, is deployed to create environments for the different ways communities use public space. The square, which is constructed from these tiles, is shown in the boards as it might appear over the week and even as it might appear 10 years hence. Though not asked for in the brief, CC001 was also the only entry to prototype an actual design component. Attached to the board is a concrete tile fitted with an electrical plug that changes colour when current is passed through it. This little presentation innovation made explicit CC001's recognition of the importance of material testing and prototyping. Ultimately, all jurors were agreed that in almost every respect, CC001 is an extremely strong proposal that deserves to be recognized as one of the two winners.

WINNER TWO

TC120

DEVELOPMENT OF NON-DIRECTIONAL SPATIAL SKELETON STRUCTURE
UK



'A great concept: to live in a concrete sponge! A brilliant idea!' This is how one of the structural engineers sitting on the jury described the TC120 entry. All of the jury, in fact, agreed that the submission created a uniquely flexible means of building with concrete, and as such dealt with robustness by showing an example of a robust design process and construction system. The proposal is for a construction system that uses pneumatic devices to create what the designers call a 'non-directional spatial skeleton structure.' The structure, created from concrete, is one of two control mechanisms that allows the designer to shape a structure using two seemingly incompatible materials: concrete, which is heavy; and air, which is light. Air is pumped into pods which are held in place by the concrete skeleton to form different-sized spaces; air pressure coupled with the skeleton are the design mechanisms that allow TC120 to create cellular spatial pockets more reminiscent of reef structures or soap bubbles than the spaces one normally finds in buildings of similar size. Indeed, the way organic and inorganic systems develop over time is more than a metaphor in this entry. Their process and the final design are, like many natural systems, remarkably adaptive and yes, robust. What is especially impressive in this regard is the iterative and interactive process of designing and testing that took the designers through several phases, adding, with each test, intelligence to their process while at the same time embedding the structural system with its own form of adaptive intelligence. While the jury agreed that the construction system created by this team was very impressive, they also agreed that the application of the system was less impressive. At times, the jury was not sure if the panels for the structural system were part of the same entry as the design, which was conventional and somewhat uninspiring. Nevertheless, TC120 was judged one of the two best entries in the competition.

HONOURABLE MENTIONS

Two entries were singled out for Honourable Mention. Each will receive 500 euro. While clearly among the best entries discussed over the course of three rounds, the Honourable Mentions were not consensus winners; that is, while some jurors felt strongly about them, all jurors did not think they were overall winners and so they did not move to the final round of discussions.

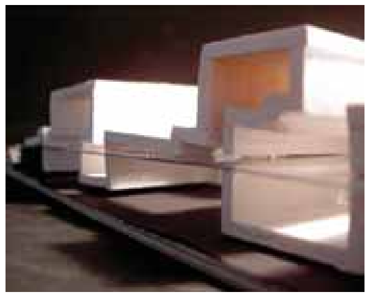
HONOURABLE MENTION ONE

SO124

HANGOVER
NETHERLANDS

The jury was very impressed with the directness, simplicity, and flexibility of the structural system developed by SO124. The presentation panels dealt with the brief in a rather implicit way by showing a concrete column system performing under many different conditions. A robust system was generated and tested by deploying a single concrete column element in multiple locations, each with its own performance criteria. The panels also made visual reference to natural structures and games that allowed the jurors to imagine the kind of strength and adaptability one might expect from the deployment of the system of columns. Several jurors observed that SO124 made for a new, more flexible domino system – high praise indeed. But the jury also thought that while the system was very robust – even as one juror noted under seismically unstable conditions – it was also limited to the consideration of one element. No mention was made, for example, about how the columnar system worked with floor plates. This relationship, if worked out more fully, might have led to an even more robust system.

HONOURABLE MENTION TWO



DK021

HAZELWOOD, COUNTY SLIGO
IRELAND

The jury was especially taken with the attention to context, nature, and craftsmanship in the DK021 entry. For some of the jury this entry was one of a very few that focused on the inherent properties of concrete. One juror remarked during the discussion, 'Now that's a real concrete project'. DK021 also dealt with the brief implicitly rather than explicitly by developing a dock that interacted with both shoreline and water. The panels featured visual connections with nature and implicitly with natural, evolving systems. The concrete intervention is thus meant as an augmentation rather than a replacement of the relationship between natural systems or boundaries such as shore and water. But while some members thought this a poetic interpretation of robustness, others felt that the entry was rather conventional and showed no truly innovative uses of concrete. Even so, most of the jury members felt it important to recognize such a project with the award of Honourable Mention.

MENTIONS WITHOUT AWARD

The jury felt strongly that the projects selected to proceed to the second round of discussions be recognized at the awards ceremony. These included the following:

NG319

GERMANY

A much-discussed project. The jury agreed that the project was extremely sensitive, well thought out and executed, but that it was perhaps stretched too thin and trying to cover too much territory. Translation: a bit ambitious for what got worked out in the end.

EB105

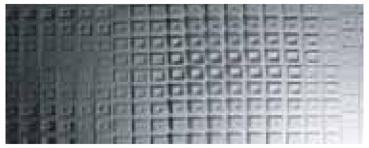
AN ACTIVE FORCE WITHIN
GERMANY

Described by the jury as very literary and poetic; but it made no real connection to fabrication or construction. One juror remarked that the entry was conventionally extraordinary. Other jurors said it was a digital storm; others still a digital salad bowl. I would take both as complements.

UW010

SURFACE ROBUSTNESS FROM SURFACE CONDITION
UK

Another much-discussed project. Paul Robbrecht, from Belgium, and I, argued strongly (to no avail) for this project which was very focused on material research and fabrication. It was also very beautiful.



LS205

I would also like to recognize LS205, Sunken Concrete Decorations, from the Netherlands (one of my own personal favourites), an entry that was much discussed but did not make it to the final rounds.
I personally appreciate the innovative nature of this project, but also recognize its real-world applications, especially for fabrication, shipping, and use.

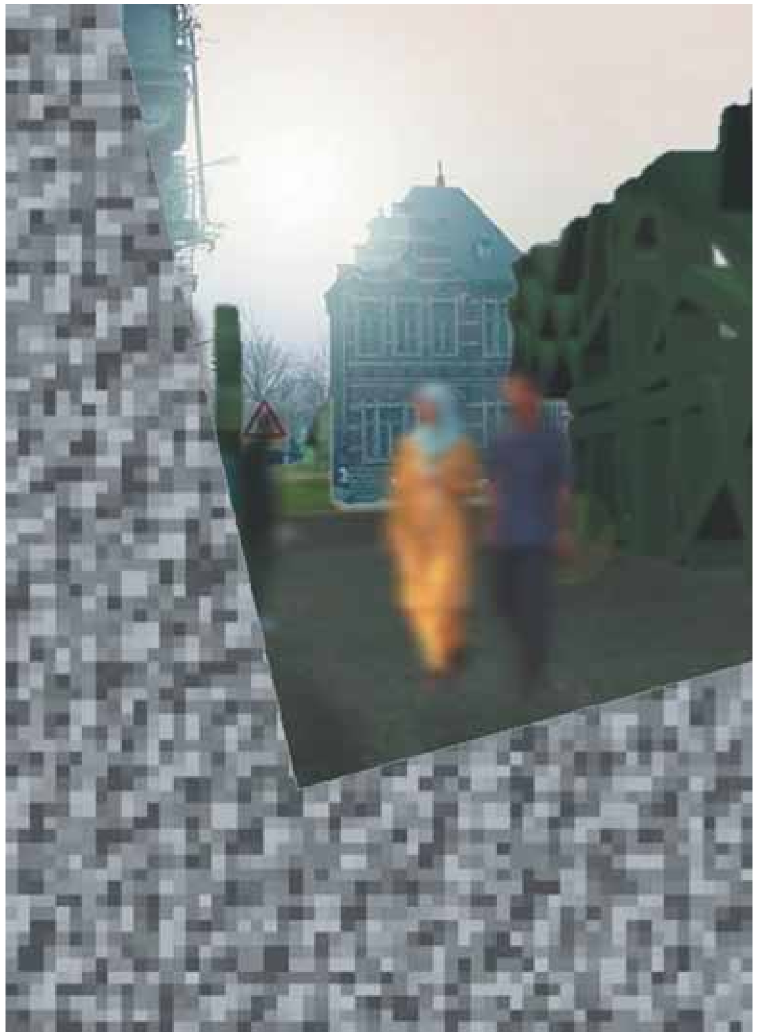
15

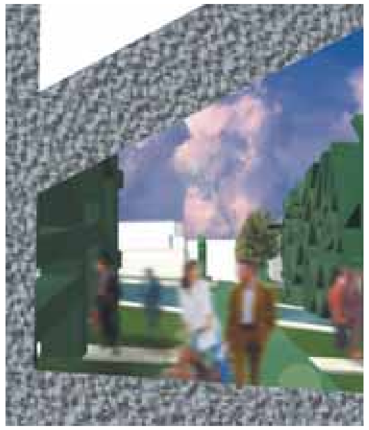
BA515

DESIGN FOR PUBLIC SPACE IN ST.JOOST, BRUSSELS

BELGIUM (national nominee)
Thomas van der Velde – Vrije Universiteit Brussel
Kenny Verbeeck – Vrije Universiteit Brussel

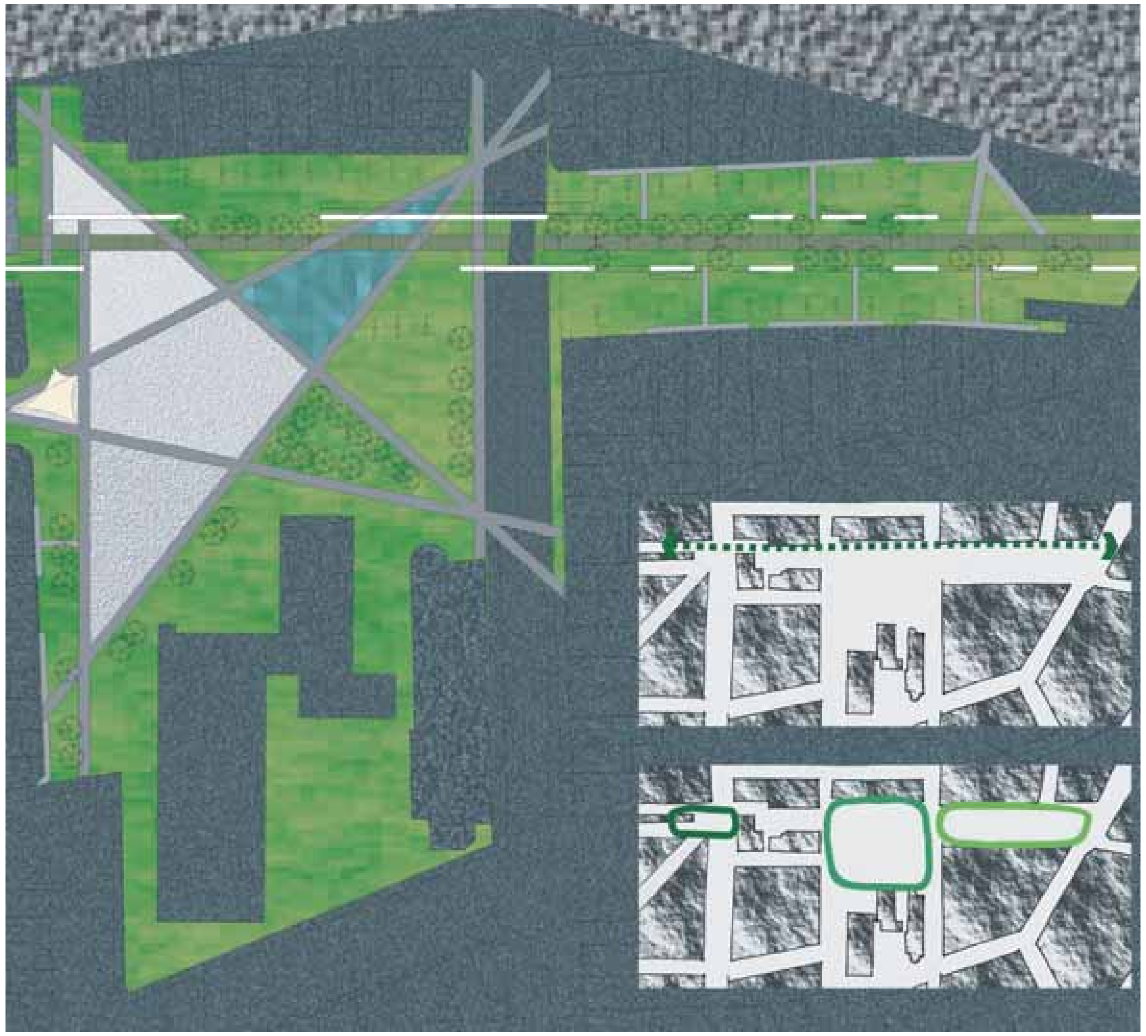
[Belgian National Jury Report] 'In response to a close reading of the configuration of the existing urban fabric, the project proposes the implant of concrete artefacts. In this sense robustness is applied to redefine and remodel public space. The artefacts are freed of conventional design conditions such a programme and function. The proposal considers the (infra)structure as merely visual and tactile objects, constitutive of public space. The alterations and erosion that will necessarily occur are understood as their specific participation to city life. In spite of the obvious naivety and the exaggerated confidence in the transformative powers of architectural interventions that characterize this proposal, the jury appreciates the reflection on robustness that emerges from an intervention concerned with the temporality of things.'





'ROBUSTNESS OF CONTINUITY > There is more to the limitations of concrete than just the physical consequences of forces and loads. According to the conception of the design, an important fraction of this material's frailty emerges as a reaction to the enduring dynamics of the neighbourhood's interaction with the superstructures.'

Plan St. Joost, Brussels
'ROBUSTNESS OF REFERENCE > The superstructures in the design act as an icon of the city, their shapes resulting from the city plan...'



BB600

DESIGNER GRAVEL

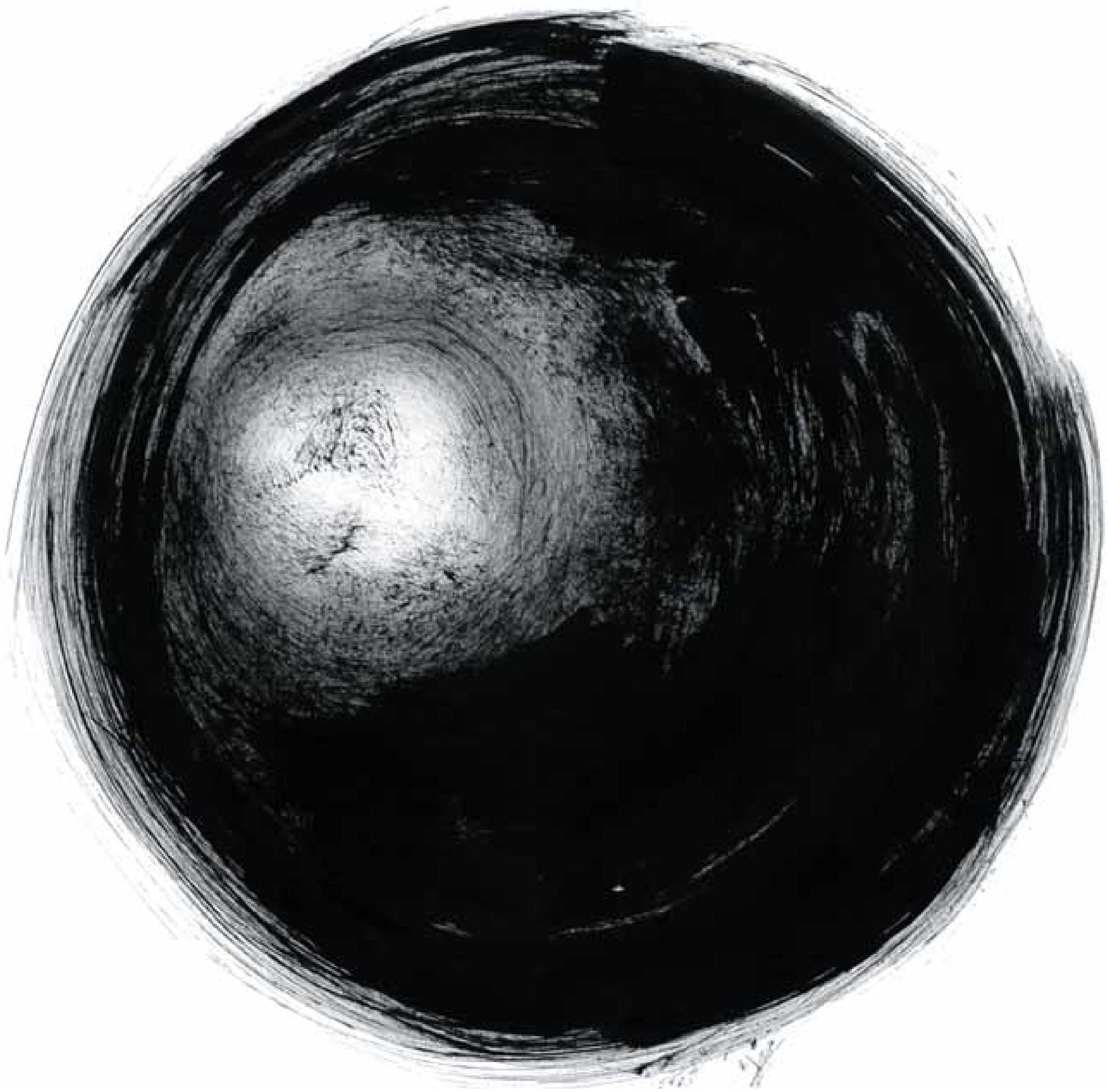
SWEDEN (national third prize)

Markus Krunegård – KTH Stockholm
Jon Mjönes – KTH Stockholm

[Swedish National Jury Report] 'The nomination is awarded third prize for its delightful contribution on the smaller scale. Broken down to the smallest component, the nomination demonstrates concrete's potential for unrestricted colour and shape, illustrated by drawings that fire the imagination.'

Designer gravel

Designer gravel could be made in various shapes, textures, sizes and colours. It could for example be used in gardens and parks, both to walk on and to look at.
We suggest producing spherical gravel, with a 15mm diameter, in black concrete.



BE358

CONCRETE TECH-SURFACE +S

TURKEY (national second prize)
Emre Çetinel – Istanbul Technical University

[Turkish National Jury Report] 'This proposal is a technological question about the future of concrete towards the sustainability of the concept robustness. It can be seen as effort to unify the material qualities of concrete with the new technological possibilities. In this sense the generic idea of "concrete tech" surfaces which are open alternative adaptations represents new conceptual and physical frontiers for the material itself. In return it is also open to create an alternative consciousness of environment. Considering such imaginative richness and its adaptation quality to the project, the jury selected this proposal for the second prize.'

'Robustness is mostly about existing for a long period of time. What's more, the final utopian aim is immortality, in the meaning of always existing or being alive. Living beings have been able to survive for millions of years through evolution. This is an inevitable process. If living beings respond to changeable environmental conditions positively, and if they are able to adapt, they have a chance of surviving. Species that fail to do this are condemned to extinction. Also, human beings develop according to new conditions. They evolved in competition with nature and other species on earth. Using their intelligence, they were able to deal with all threats that crossed their path.

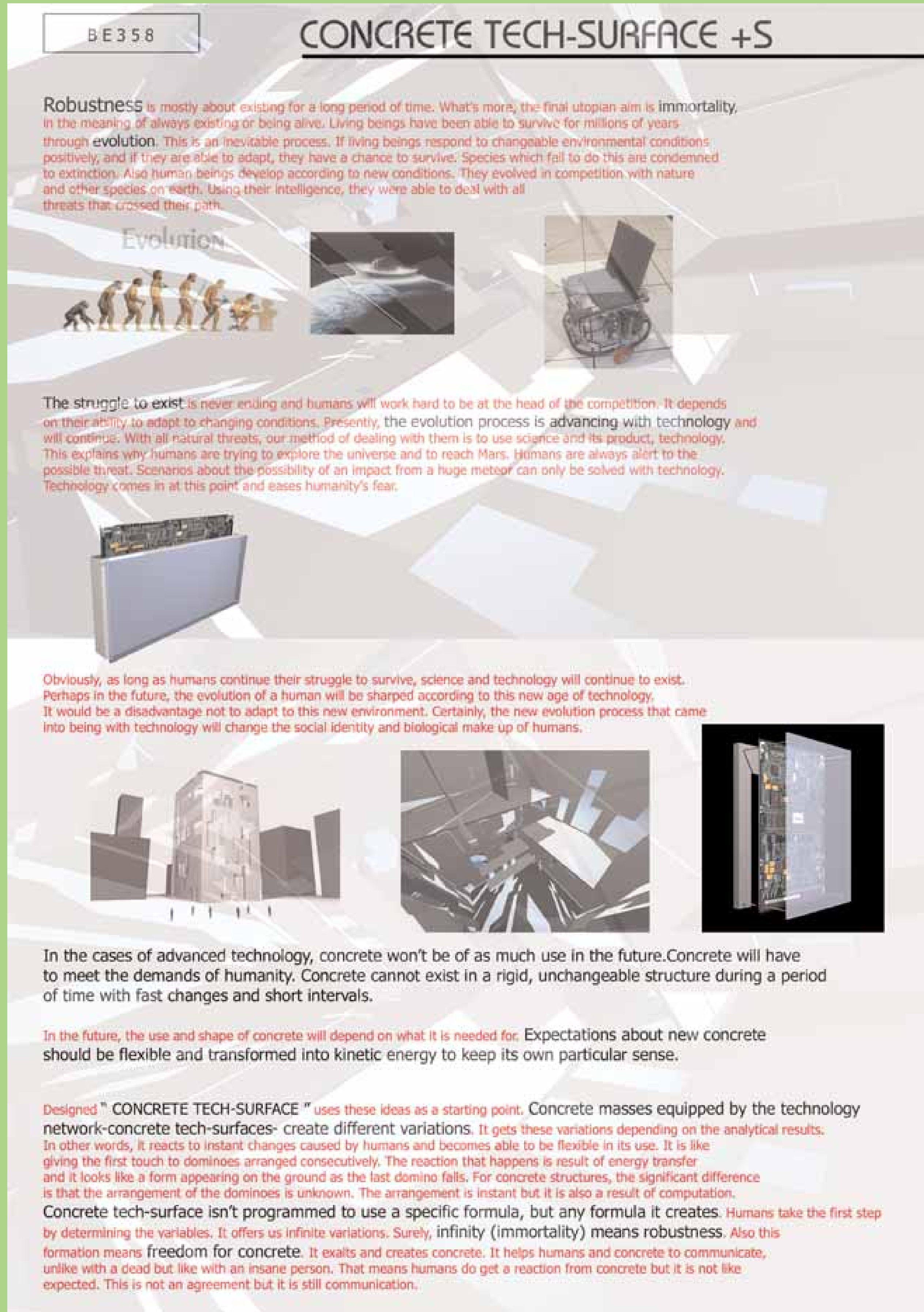
The struggle to exist is never ending and humans will work hard to be at the head of the competition. It depends on their ability to adapt to changing conditions. Presently, the evolution process is advancing with technology and will continue. With all natural threads, our method of dealing with them is to use science and its product, technology. This explains why humans are trying to explore the universe and to reach Mars. Humans are always alert to the possible threat. Scenarios about the possibility of an impact from a huge meteor can only be solved with technology. Technology comes in at this point and eases humanity's fear.

Obviously, as long as humans continue their struggle to survive, science and technology will continue to exist. Perhaps in the future, the evolution of a human will be shaped according to this new age of technology. It would be a disadvantage not to adapt to this new environment. Certainly, the new evolution process that came into being with technology will change the social identity and biological make-up of humans.

In the cases of advanced technology, concrete won't be of as much use in the future. Concrete will have to meet the demands of humanity. Concrete cannot exist in a rigid, unchangeable structure during a period of time with fast changes and short intervals.

In the future, the use and shape of concrete will depend on what it is needed for. Expectations about new concrete should be flexible and transformed into kinetic energy to keep its own particular sense.

Designed "CONCRETE TECH-SURFACE" uses these ideas as a starting point. Concrete masses equipped by the technology network-concrete tech-surfaces- create different variations. It gets these variations depending on the analytical results. In other words, it reacts to instant changes caused by humans and becomes able to be flexible in its use. It is like giving the first touch to dominoes arranged consecutively. The reaction that happens is result of energy transfer and it looks like a form appearing on the ground as the last domino falls. For concrete structures, the significant difference is that the arrangement of the dominoes is unknown. The arrangement is instant but is also a result of computation.
Concrete tech-surface isn't programmed to use a specific formula, but any formula it creates. Humans take the first step by determining the variables. It offers us infinite variations. Surely, infinity (immortality) means robustness. Also this formation means freedom for concrete. It exalts and creates concrete. It helps humans and concrete to communicate, unlike with a dead but like with an insane person. That means humans do get a reaction from concrete but it is not like expected. This is not an agreement but it is still communication.'



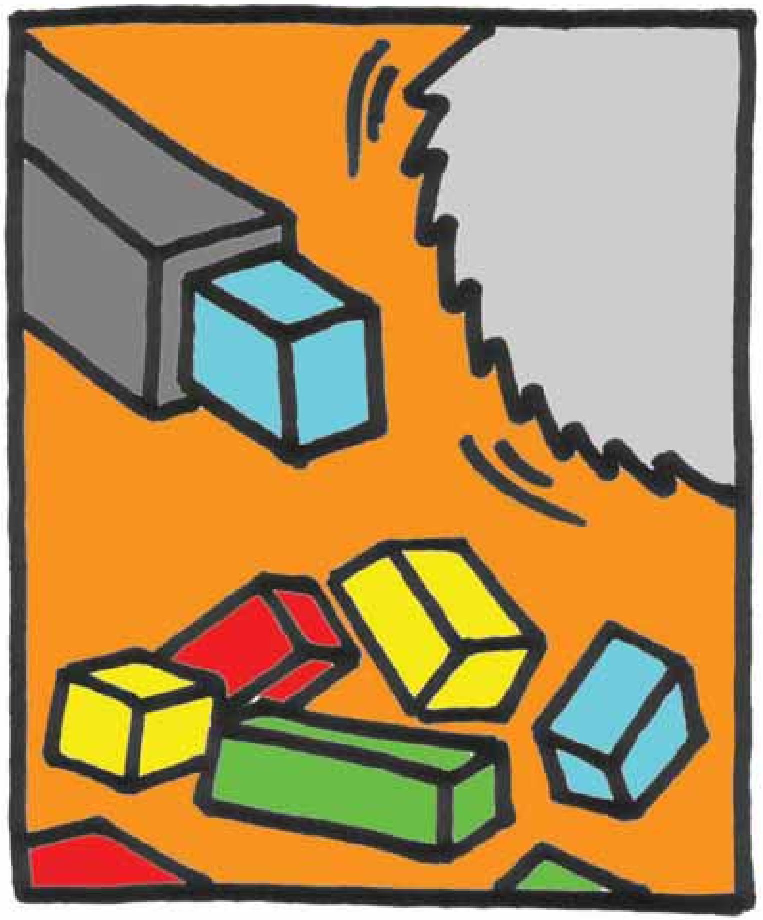
BX042

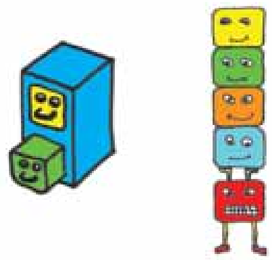
THE GENESIS OF LIGHTWEIGHT CONSTRUCTIONS MADE OF CONCRETE, OR: WHAT CAN WE DO WITH THE CEMENT MIXERS?

BELGIUM (national nominee)

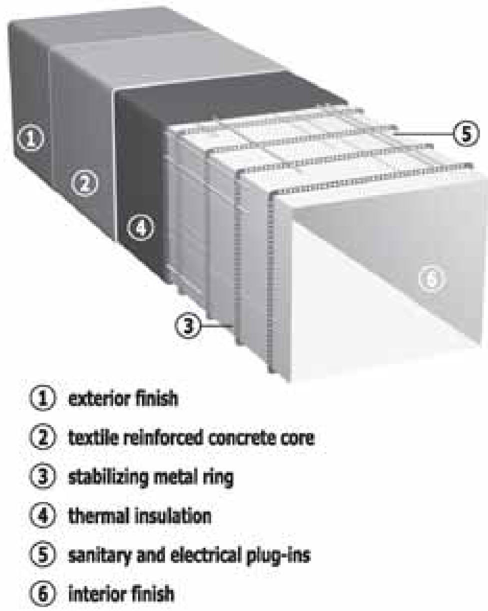
Sebastian Kreusch – Institute Supérieur d'Architecture Saint-Luc de Wallonie, Liege

[Belgian National Jury Report] 'This project examines new possibilities for the industrial production of a metastructure. Extruded concrete tubes are produced with the technology of fibre armament. The project claims to propose a new typological element and to fulfil essential demands of housing. The jury welcomes the ambition to apply design in a domain that goes beyond formal and functional determination. The entry is, however, simple-minded in its approach and lacks precision in the architectural development of the premise.'





'Traditionally, concrete is used for massive construction. The protection of the steel reinforcement against corrosion and high temperatures in case of fire disaster as well as the traditional construction techniques (both cast on site and prefabricated) condemn concrete to massive construction. But lightweight constructions made of concrete are going to be possible in the near future using textile reinforcement.'



CC001

OPEN SOURCE
UNITED KINGDOM (national first prize, INTERNATIONAL WINNER)

Christopher Glaister – Royal College of Art, London
Afshin Mehin – Royal College of Art, London
Tomas Rosén – Royal College of Art, London

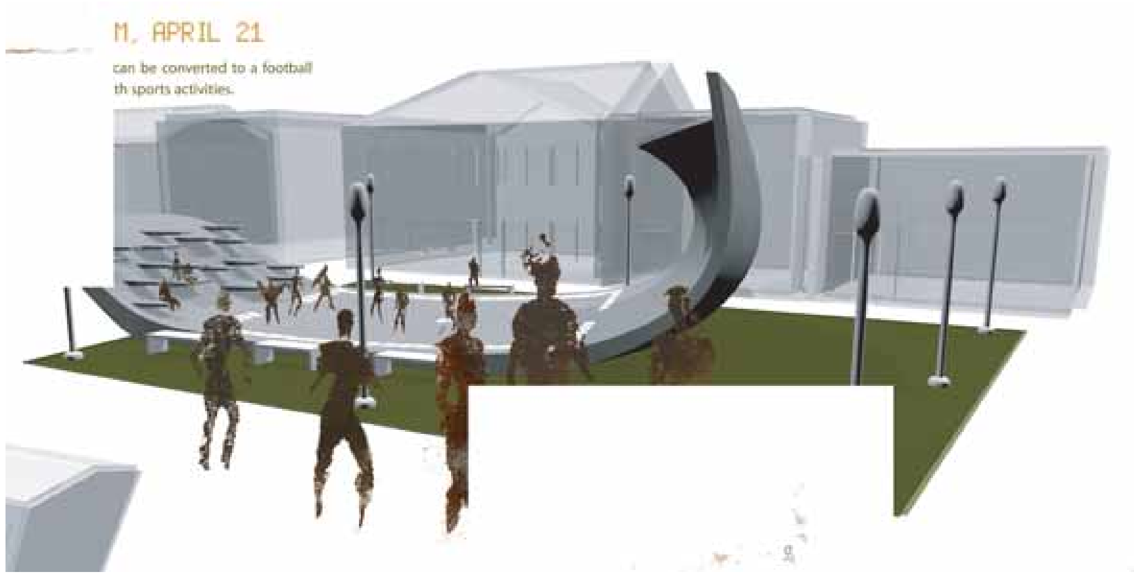
[UK National Jury Report] 'Open source derives its name from computer software development community, and refers to the practice of open sharing of software over the internet, and abandoning restrictions to enable all users to obtain, modify and re-release the software as they wish.

The same concept has been used for this entry, which envisages a public square, made out of a robust concrete structure which constantly evolves through the activities of a community, adapting to meet their needs and desires.

Colour-changing concrete has been employed to create a vast digital display which can change the patterns on its surface in minutes. These patterns themselves are designed and evolved by members of the community who use the square. Facilitating different activities, the patterns and colours could include the markings of a football pitch, borders for setting up a market place, and a ring to encompass street performers. The community can continually suggest new designs.

At one end of the square there is a large screen which can be used to display information. In this way, as with the software, rigid structures are abandoned and the community is allowed to design to meet its own needs, and develop as sense of shared ownership.'
(also read: International Jury Comments Curator's Summary)

Actual working prototype (tile)
'Open Source incorporates a technology which has been developed by CC001 which allows the colour of a concrete surface to be actively changed. Furthermore the area of colour change can be controlled to enable specific sections to change at will. By arranging the controllable areas in a grid of pixels and controlling them via a computer, the concrete surface can be made to act like a digital display.'



JULY 20-25

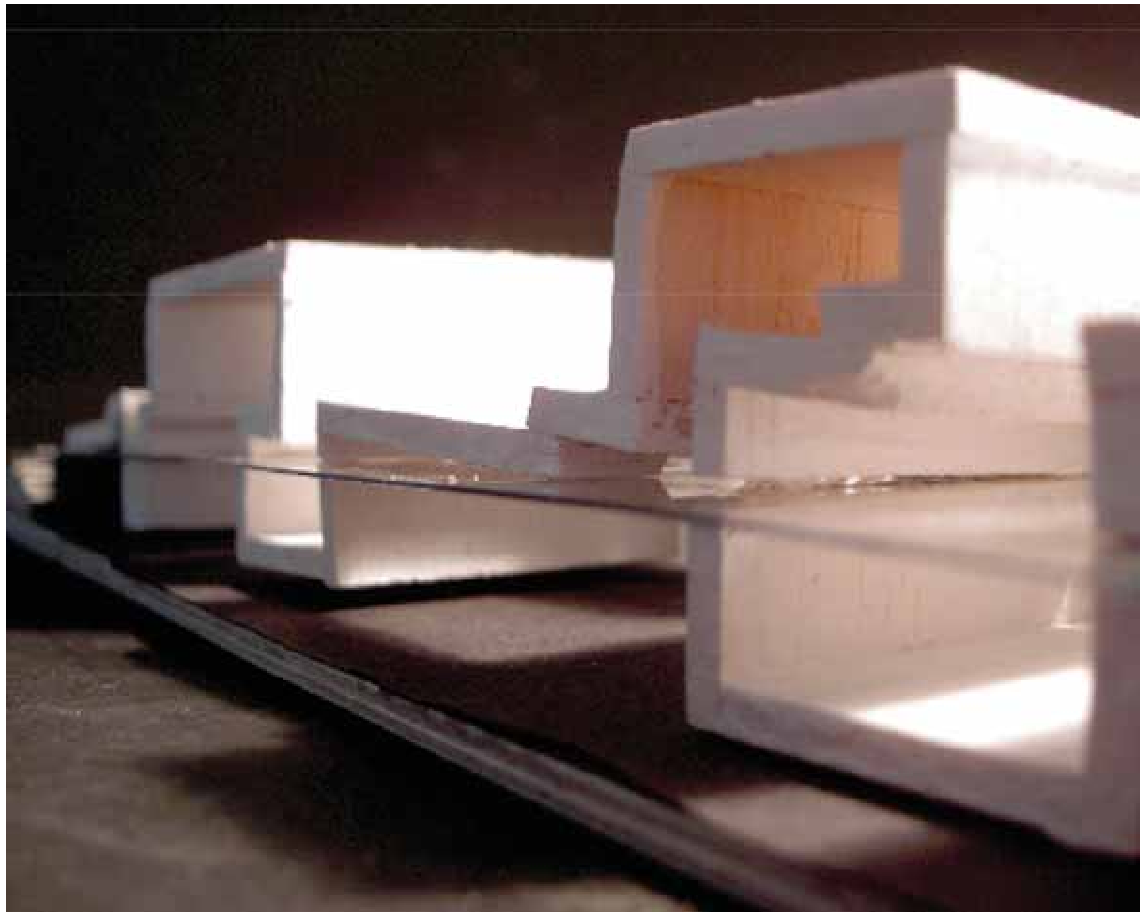
During the summertime, the square can be used for a street performers festival for the entire week. Also childrens activities could involve drawing images that are projected on the large display.

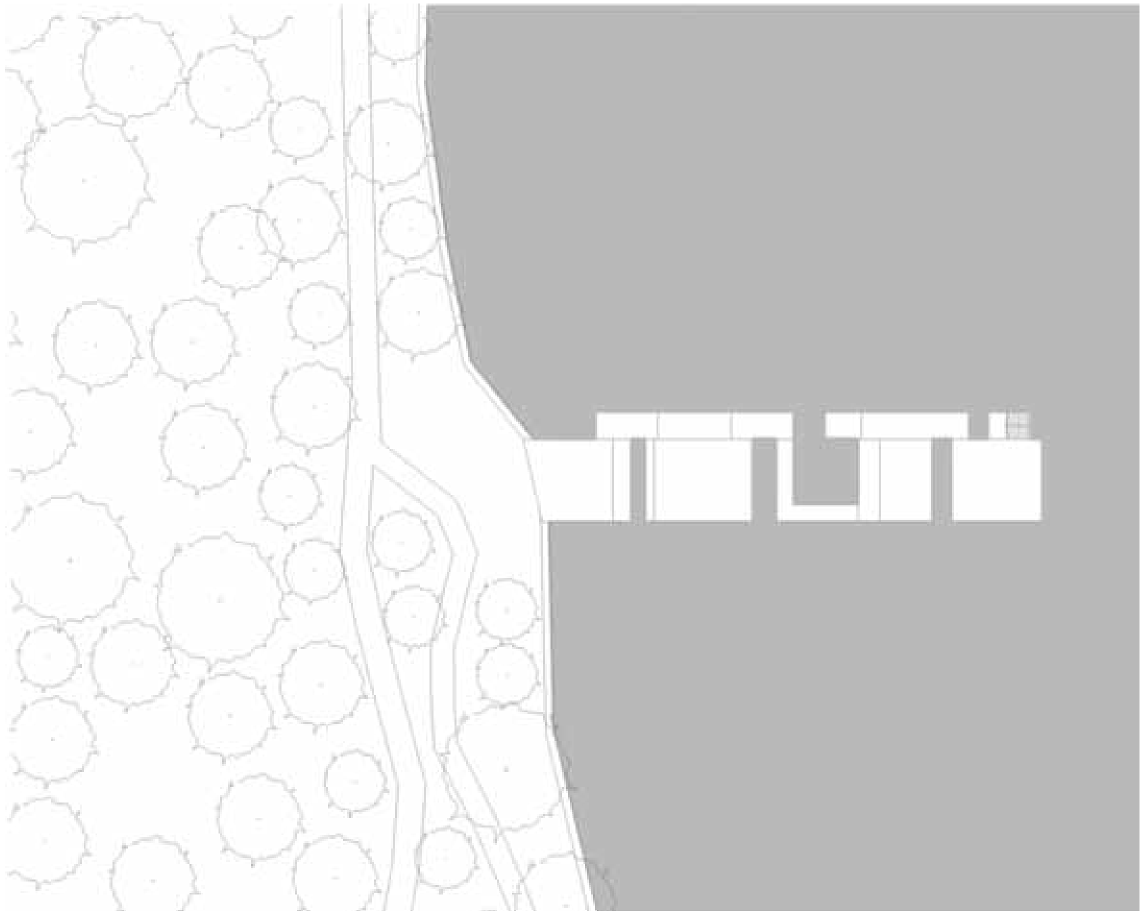
DK021

HAZELWOOD LAKESIDE PIER
IRELAND (national second prize – ex aequo)
INTERNATIONAL HONOURABLE MENTION)
David Kelly – University College Dublin

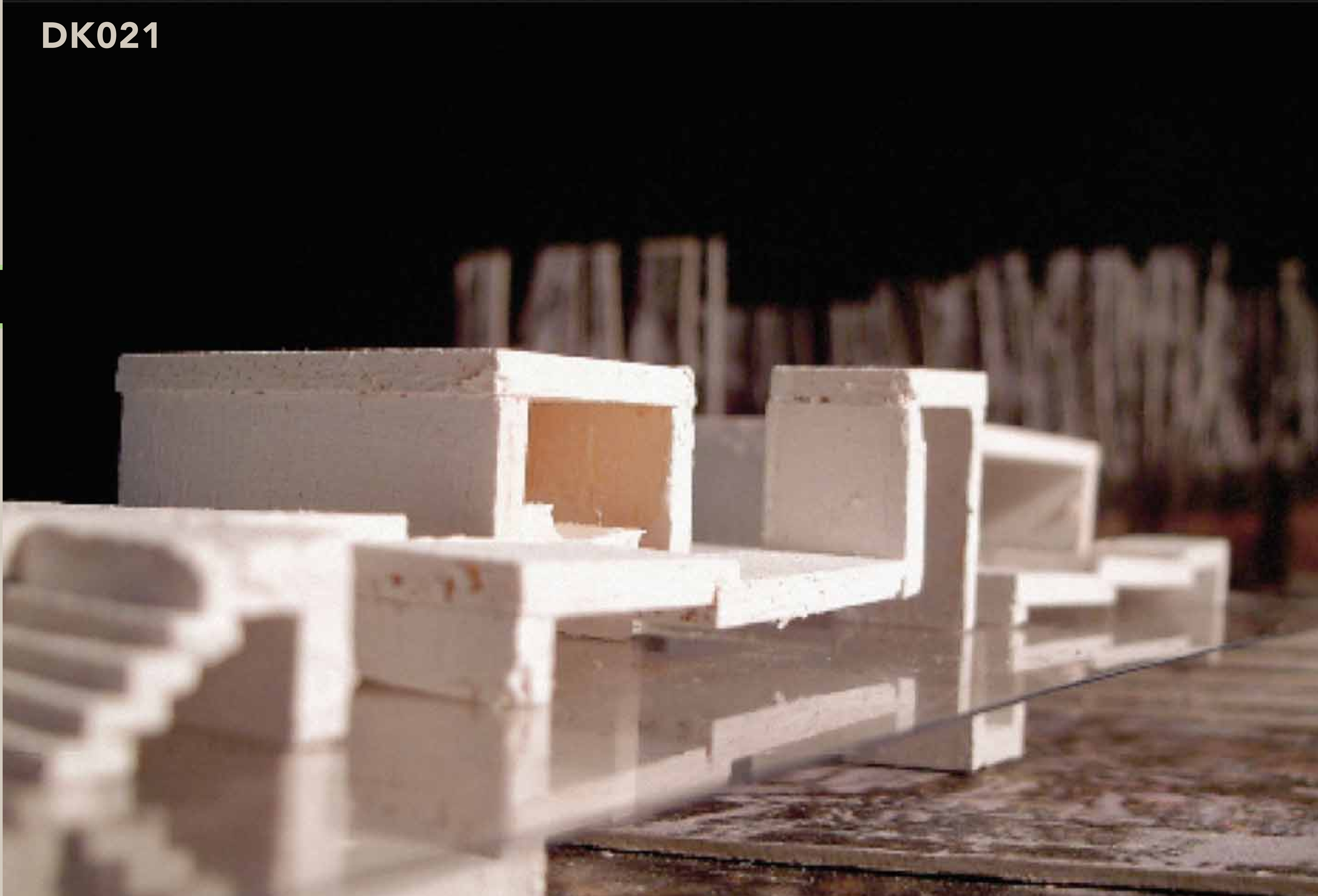
[Irish National Jury Report] 'Hazelwood Lakeside Pier ('building'): captures the texture and colour of the lakeside landscape in its stillness. Situated beside a renowned forest sculpture park, the design hovers between building and sculpture. Taking an elemental approach to making space and form in a single material, this is an exercise in exploring the limits of concrete as a folded flat plane. The landing site effortlessly accommodates different functions – walking, swimming, docking – even if the design fails fully to engage with the water: the form of the installation is, rather unsatisfactorily, similar above and below the waterline. Although it owes something to Allied Works Architecture's Maryhill Overlook in Goldendale, Washington State (1997-99), the entry demonstrates convincingly that no material other than concrete could achieve this design: ultimately, it is 'tectonic', meaning it embodies 'the poetry of construction'.'

(also read: International Jury Comments Curator's Summary)





DK021



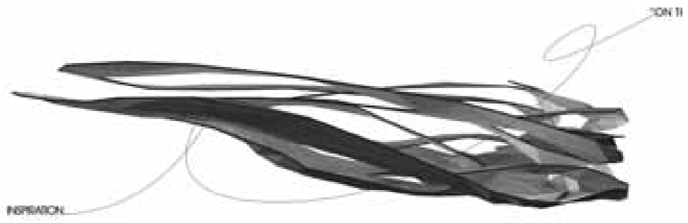
EB105

AN ACTIVE FORCE WITHIN

GERMANY (national nominee)

Daniel Zajsek – Fachhochschule Kaiserslautern

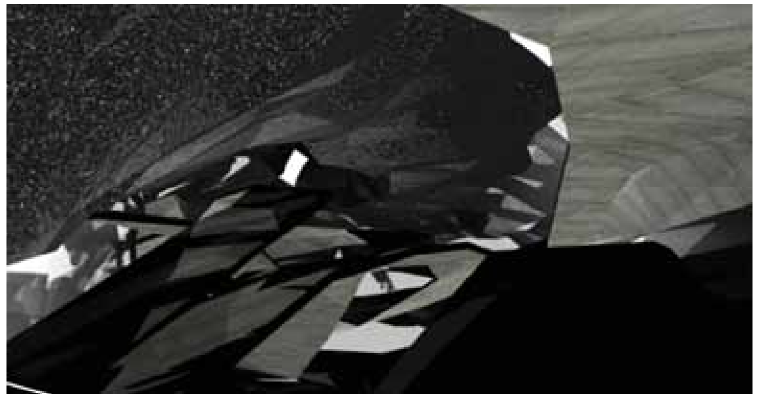
[German National Jury Report] 'The design, with the theme of life as a process in the sense of mental Robustness, awards the honour with the visionary, dynamic process of developing the form. The design reflects the aspects of solidity and motion, elasticity and stability, static and dynamic.'
(also read: International Jury Comments Curator's Summary)

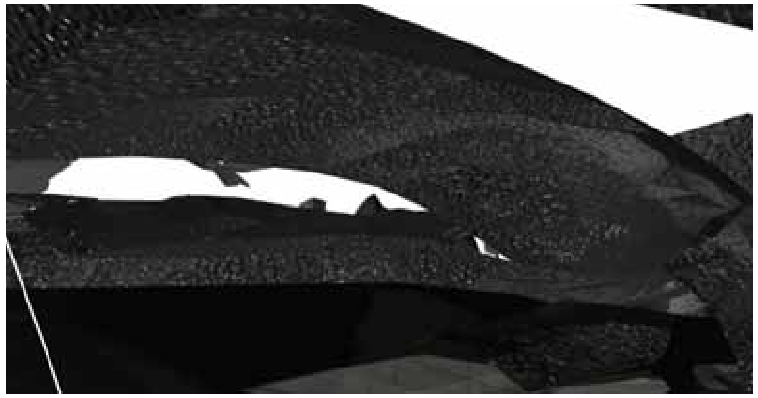


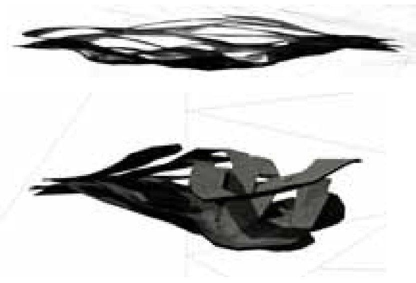
Inspiration / Impressions
'The concrete waves reflect life in its robust mode and continuance. They project the tenacious strength in every living being. The aluminium-glass case forms an independent surrounding frame and space. The carbon veil shrouds the scenery in a mystic light and represents the unfathomable nature of life.'

A ray of concrete increases to a complex structure. The streams develop waves which drift apart and form a network of winding passages. The waves reflect life as a process of energy transformation from an immaterial condition into different forms of life. The complex structure is a continuous organism and projects to the visitor the complex relations between evolution and life. The use of concrete creates a complete structure from fragments which symbolise individual beings forming one organism. Coming together for one purpose. Solving an equation resulting in a perfect harmonious outcome.'

Interior
'The concrete is creased like a crumpled piece of paper and forms different reflections on the faceted surface. The curved ramps flow through the interior and pile up to breaking waves, forming a play of light. The aluminium-glass case breaks the sunlight like lenses and adds to the affect of subtle exposure. The scenery becomes completed by the carbon veil. It's fragmented surface shrouds the interior in a mystic mood and multiplies the formal effect.'







Life / Robustness / Eternity
'The principle of life has no beginning and no end. It exists eternally and is sublime in spite of time and it finds its way through all dimensions. Life changed its form by evolution and time but its strength never changed. Life is the apotheosis of an eternal phenomenon. It's the most robust subject because it is not bound by matter and is reborn again and again.

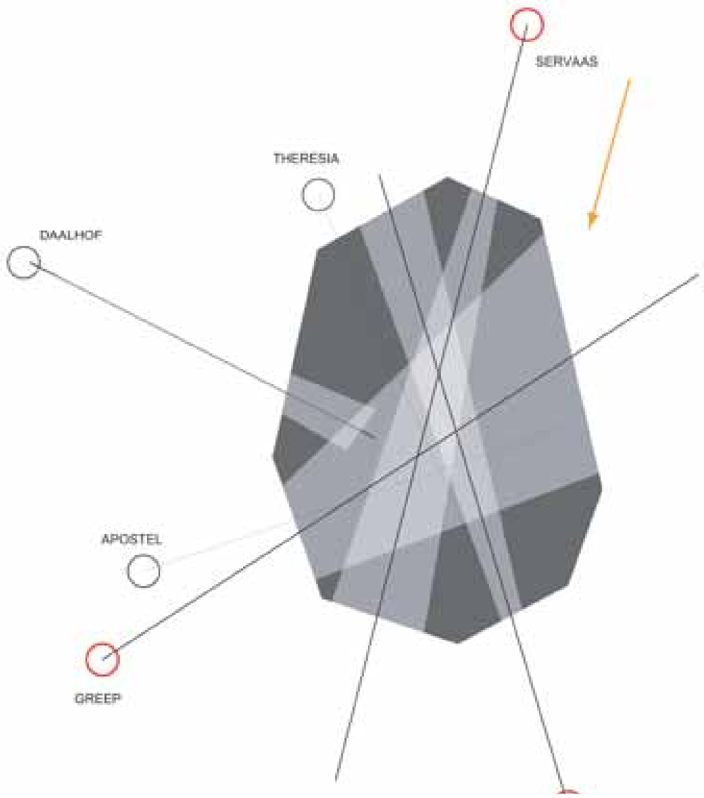
EN888

THE WANDERING STONE

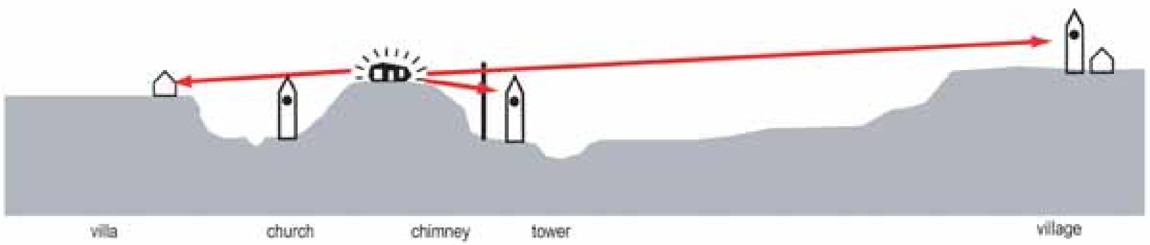
NETHERLANDS (national second prize)

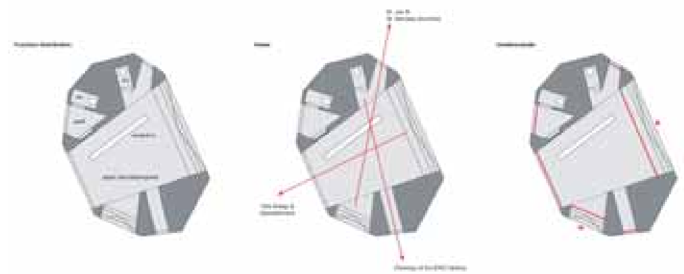
Bas van der Pol – Technical University Delft

[Dutch National Jury Report] 'An architectural design for a visitor pavilion. The concept is poetic and also absolutely robust. The building is conceived as a solid mass, one huge stone with carved spaces, similar to the cave systems in the mountains nearby. In this way the concrete is not used as a cladding material, nor as just a structural element, but all in one. Most interesting is the idea that the aging of concrete can be used in a positive way.
The jury regrets that the entry doesn't give indications on how the aging could be used as a design element, how the aging can be influenced or controlled.'



Concrete = artificial STONE
'Robustness was the theme for the competition. So I chose to make the pavilion as robust as I could possibly think of: it became one big solid block of concrete, sort of like the hill it came from. Then I dug out tunnels, directed to the interesting views you encounter when walking on the St. Pietersberg plateau. This block now not only captures the hidden qualities of the St. Pietersberg and the industry it generated, but it also captures the exciting qualities of its surrounding landscape. Visually, the pavilion relates to the 'zwerfkeien' which lie around on the plateau.'





'The surface of the block will adapt to its surrounding nature: testifying this 'zwerfkei' of which several lie around on the plateau – probably transported there by people because they are usually found in the valley of the river Maas – lichens (mosses) and algae grow on them. Another nice aspect of these boulders are the surfaces, on which we find puddles of rainwater which reflect the sky and nature. All aspects that will be visible as well in the pavilion. Maybe the cracking of the concrete when drying could be used as an expressive element…'

EZ279

MUSIC BOX

GERMANY (national nominee)

Marjeta Zupancic – Hochschule Wismar

[German National Jury Report] 'The little work with the title Music Box is based on the haptic qualities with which robustness is transposed in its original meaning. The composition of open and closed surfaces is poetic. The atmosphere of the spaces is determined by the proportions. Surface, slit, whole and screen create a performance of light and structure the atmosphere of the interior. The natural roughness underlines the sympathetic design of the object reminiscent of the first house (with natural light).'

'All the openings are specially designed to enable sunlight to penetrate the object and create interplays of light and shadow – lightscapes.
As the sun travels across the sky, the light lines inside the box change, each moment being one chord of a day – symphony. The sun changes its way from day to day, in the summer being the highest, in the winter the lowest. Every day of the year has its own composition.
There are only three openings, skylight – the point, window – the line, door – the surface.
The point is the smallest unit of light, appearing only in the summer, when the days are long and the sun is powerful.
The line is the main instrument; a light line is travelling through the room, presenting a dramatic cut of light in the darkness. And from the outer side, it's a frame for always changing pictures inside.
The surface, the biggest opening, is divided in a rhythmical pattern, developing the grand crescendo. The wall is thick and rough; the light is breaking on every edge, entering the room in a soft dispersed way but still creating strong shadows. The play of shadows and light inside, but also on the structured bars, creates new overlapping patterns.
The concrete, robust, cold, hard, solid, constant.
The light, soft, immaterial, warm, always changing.
Perfect combination.

WHY
'Only concrete can when touched by sunlight create a mixture of soft dispersed illumination and sharp shadows, cold surrounding warm light, solid environment for immaterial lightscapes, always constant en yet never the same.'

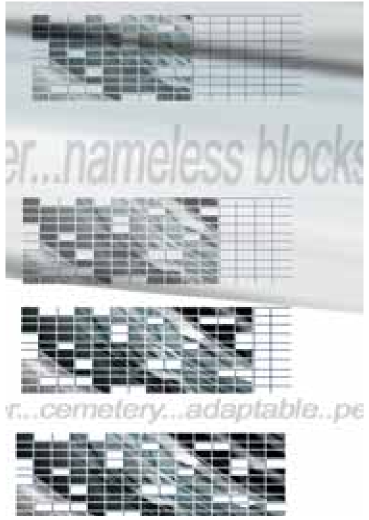
FP713

A FLUID WAY OF REMEMBRANCE / AN EVER LASTING CONCRETE CEMETERY – AIDS MEMORIAL

TURKEY (national first prize)

Güney Cingi – Middle East Technical University, Ankara
Basak Uçar – Middle East Technical University, Ankara
Tuba Karpuzoglu – Middle East Technical University, Ankara

[Turkish National Jury Report] 'This proposal unifies the potentials of the concept and the material with a sensitive public issue and tries to find a way to represent "a fluid way of remembrance" with an "ever lasting concrete cemetery". Robustness in this proposal gains a wider meaning, a social issue simulated by the nature of the material and also the proposed architectonic quality is open to sense in urban scale, trying to create a robust social consciousness. Considering the conceptual background of the project as well as its internal consistency, scale-based sensitivity and presentation quality jury selected this proposal for the first prize.'



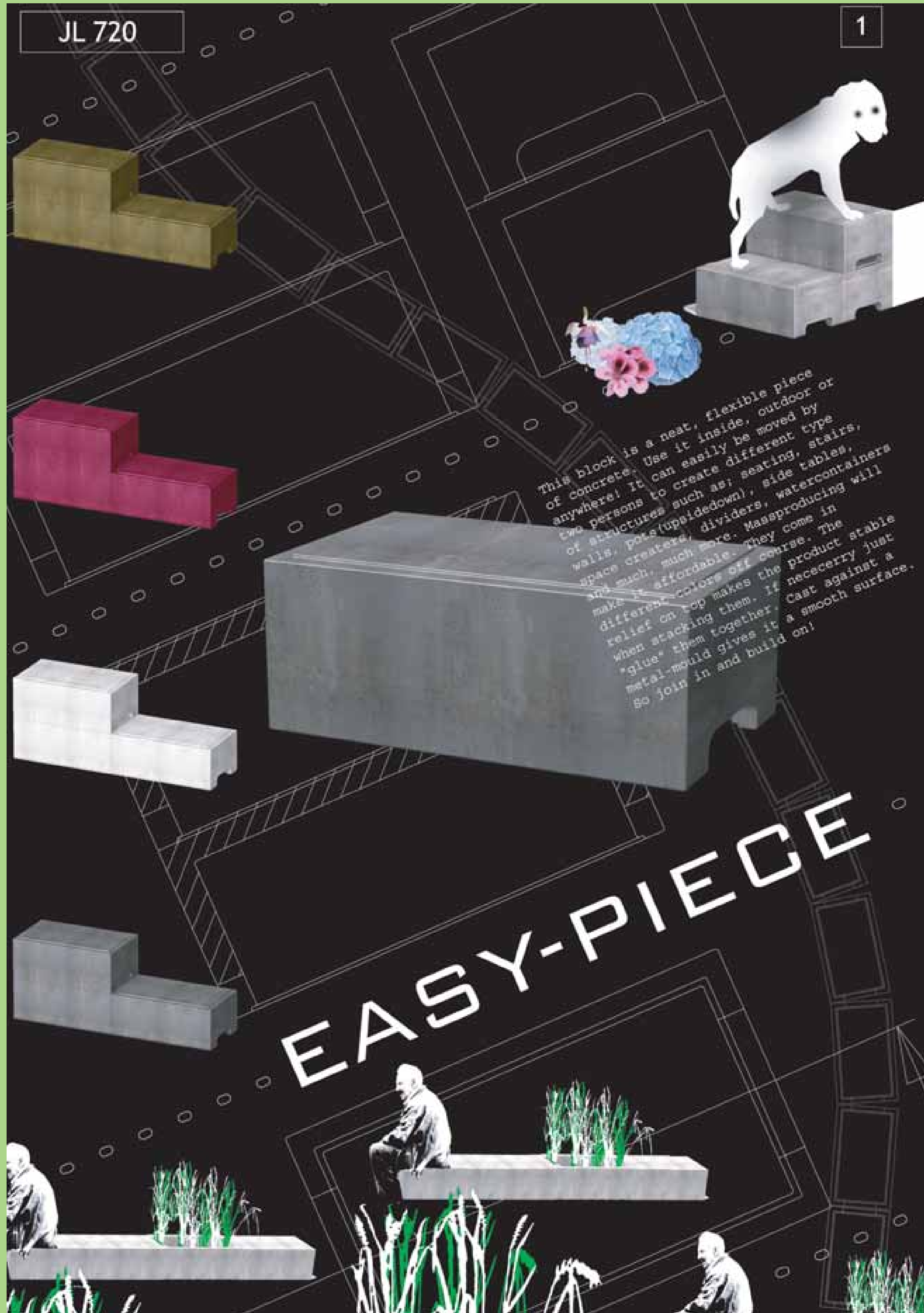
'Where the margins of remembrance recall for the memorials that honour the dead(s) and remind of their lives, it is sempiternal to memorialize and reinterpret its visions…
Time may blur what we are reminded of while formalizing the transformation through experience…
A temporary installation of memorial dedicated to people who have died of aids, suffering and survived from it…
An ongoing memorial with modular concrete blocks…
Systematization of death and life where each person is coded with a single pre-cast block… Abstract tombs replace "nameless" blocks with personal memorial expectations where death alters hope for life…
Emptiness is the resolution of the memorial, liberation from plague… It is a fluid way of remembrance adapting itself to the new experiences, changing images with deaths, births and hopes…
Not only an everlasting concrete cemetery from all nations and ages but also a call to the world…'

JL720

EASY-PIECE
SWEDEN (national second prize)
Jens Laursen – LTH, Lund

[Swedish National Jury Report] 'The nomination shows how simple building blocks can be combined to make practical and easy-to-handle elements, suitable for a garden, where the format can make the term "concrete" comprehensible to a child.'

'This block is a neat, flexible piece of concrete. Use it inside, outdoors or anywhere! It can easily be moved by two persons to create different types of structures such as: seating elements, stairs, walls, pots (upside down), side tables, space creators, dividers, water containers and much, much more. Mass-producing will make it affordable. They come in different colours of course. The relief on top makes the product stable when stacked. If necessary just "glue" them together. Cast against a metal-mould gives it a smooth surface. So join in and build on!'

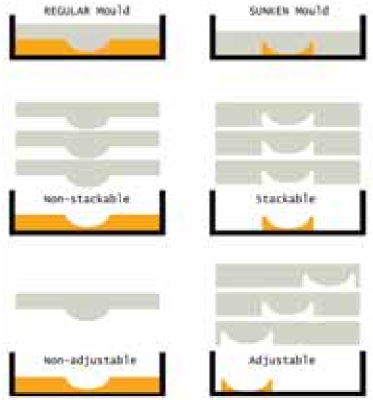


LS205

SUNKEN

NETHERLANDS (national first prize)
Luc Schouten – The Design Academy, Eindhoven

[Dutch National Jury Report] ‘In this project the designer seems to be triggered by the repetitive production process of pre-cast concrete, which is very suitable for making decorative elements. Nevertheless, pre-cast concrete is usually applied for technical and structural objectives. By rethinking the production process, a standard product can be produced with references to traditional craftsmanship.
The ornaments are sunken in the elements, thus not hindering the stacking, transport or handling. The idea of ‘bas relief’ in concrete is unique. The very classical decorative motives, referring to stucco, are placed in a new context and acquired new meaning.
The presentation is strong and convincing. Just two pictures tell the whole story: on the one hand a rectangular space, built out of flat concrete floors and walls, efficient but dull; on the other hand a similar space, breathing an atmosphere of richness, because of the decorations in floor and wall elements.
Without doubt the best entry. Smart and robust.’
(also read: International Jury Comments Curator’s Summary)



‘Because of the way our houses are built nowadays, decoration has disappeared. By using pre-fabricated concrete elements it’s possible to build much faster and much more efficiently, but without decoration our houses would remain empty.
The aim of the Sunken project is to integrate decoration into the process of casting prefab concrete.
By pushing back the decorations into the wall, sinking them, it is possible to integrate them in the prefab production process. The decorations are pushed back underneath the top surface of the concrete, making it possible to stack and transport the prefab parts in the usual manner.
Because the decorations are sunken, they can be applied at any desired location, without needing a new mould for every new position.’

MA029

ALPINE VISITOR CENTRE / BRIDGE

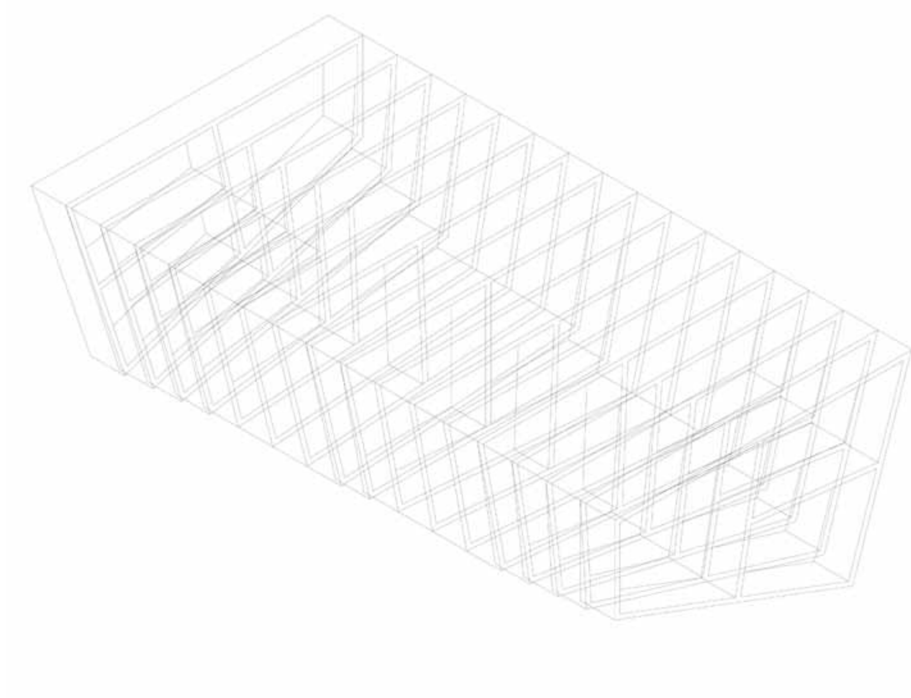
IRELAND (national first prize)

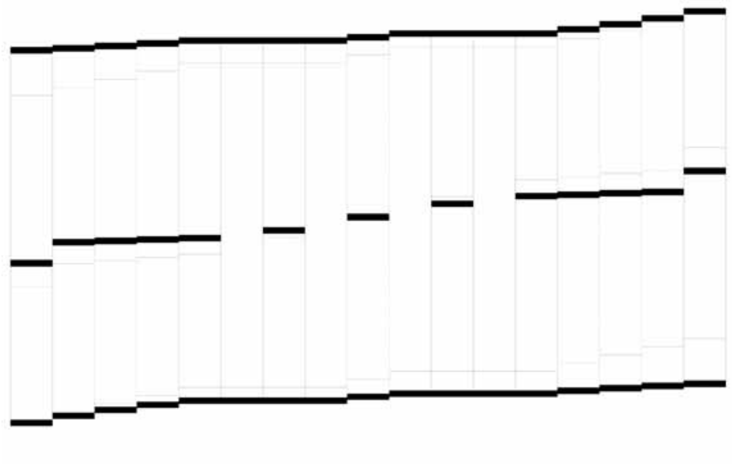
Matthew McCullagh – University College Dublin

[Irish National Jury Report] 'Alpine Visitor Centre / Bridge ('landscape'): avoids becoming a building and instead chooses to exist where art and architecture meet. The photographs of the model illustrate a bleak mountain landscape, surprisingly cast from rough and dirty concrete: this 'natural Alpine ravine', bridged by an alien, man-made object, makes the only connection necessary with the theme of the competition. Although perhaps not fully committed, the entry – based on an understanding of pre-cast concrete, whether informed or not – displays remarkable clarity, from concept to visualisation. Lightly balanced on one corner at each end, the heavy span touches the earth with the poise of a dancer, creating a delicious tension. 34 cross-sectional drawings and 17 models describe the post-tensioned pre-cast concrete sections, each one unique but necessary, like a vertebra or the sequentially sliced traces recorded by a diagnostic scanning machine. This contrasts vividly with the normally repetitive nature of pre-cast concrete. There are questions, of course: where is the door and what is the view? Best thought of as an object in the landscape or some new kind of internal space (that needs no additional 'validation' as a visitor centre), the abstract quality of this design leaves our ruminations on the nature of robustness satisfactorily open-ended.'

'The seventeen concrete sections post-tensioned together and spanning the ravine on the site. The building forms a bridge across the ravine, and once inside the building the views of the alpine region are framed by the large openings at its ends.'

'The seventeen sections used to create the form of the visitor centre. Subtle changing and morphing of the section create complex interesting internal spaces and volumes. Once the sections have been assembled and post-tensioned, they form an efficient beam capable of spanning the ravine where the project is sited.'





Plan B-B

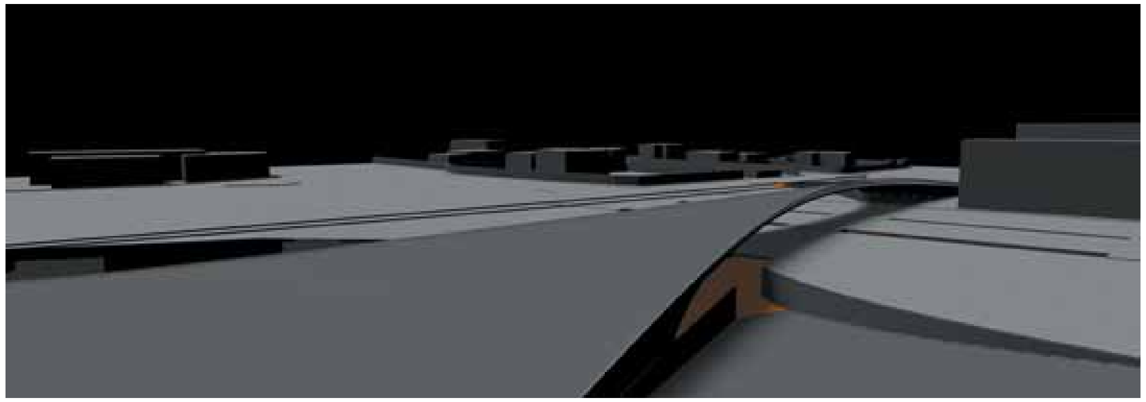
Section A-A

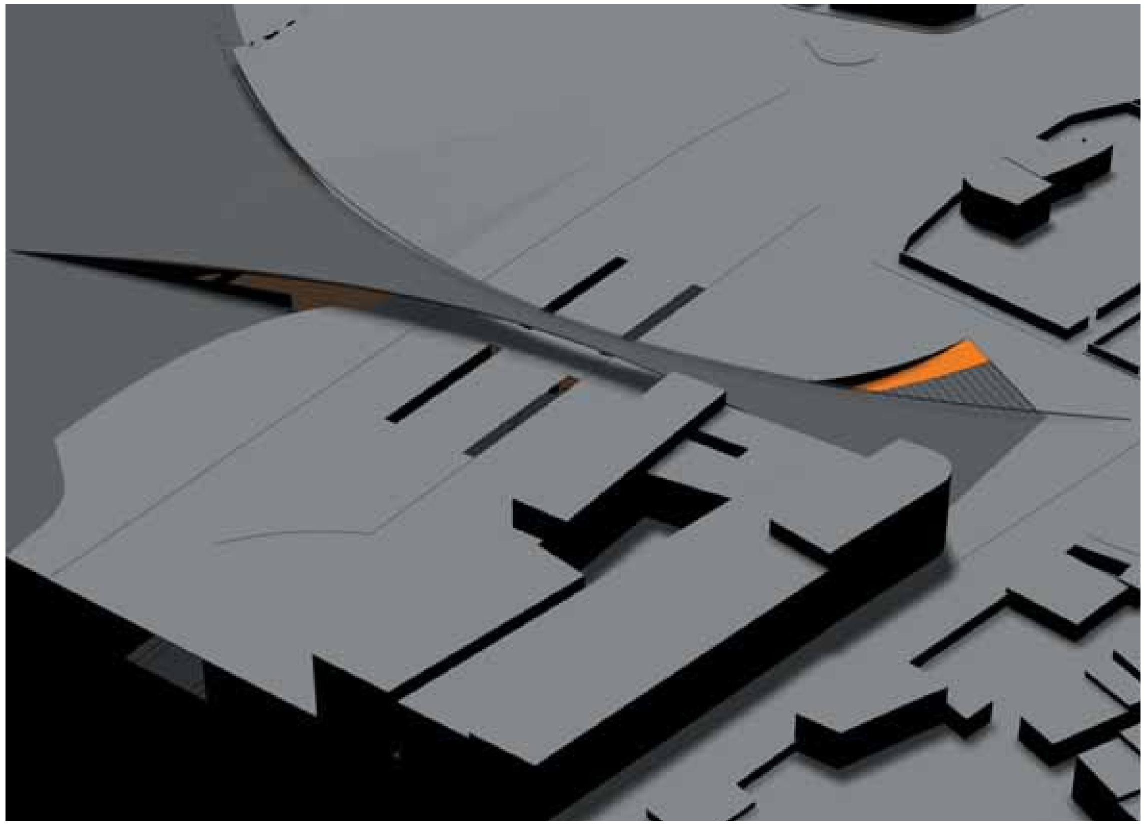
MV999

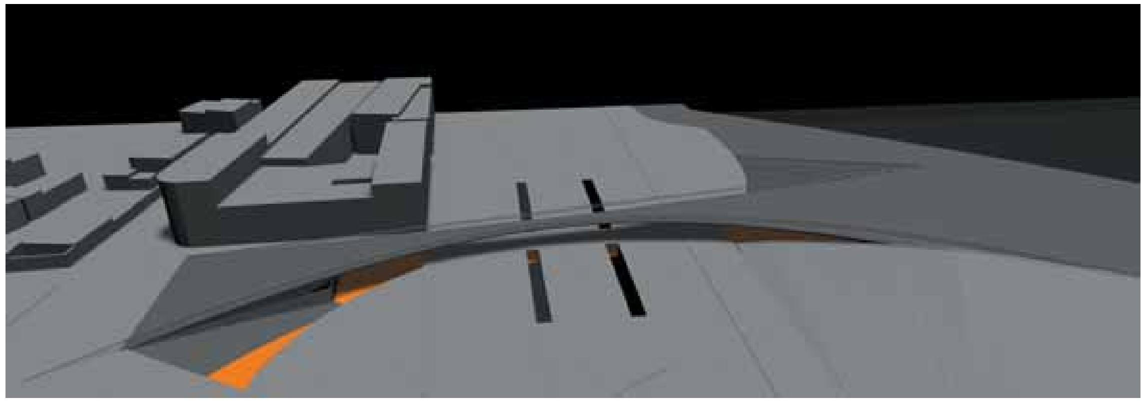
PORTUGAL (national nominee)

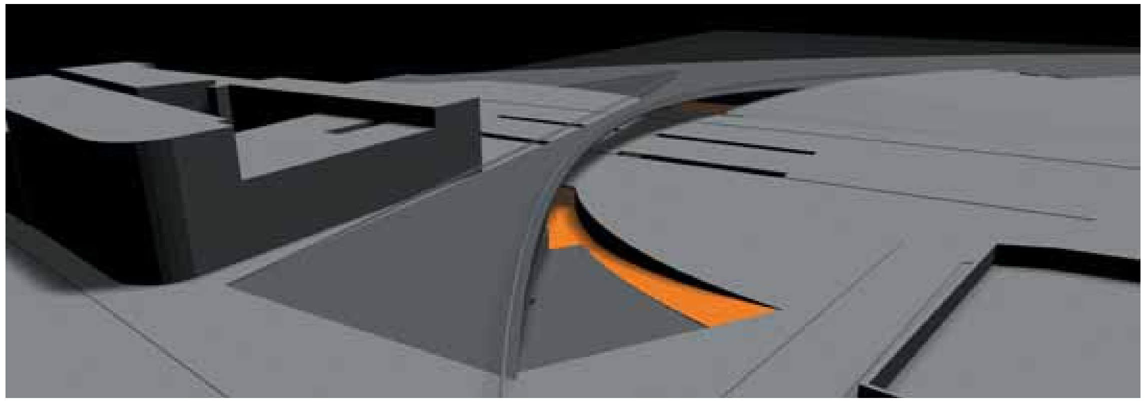
José Manuel Vacas – Universidade Lusiada de Lisboa

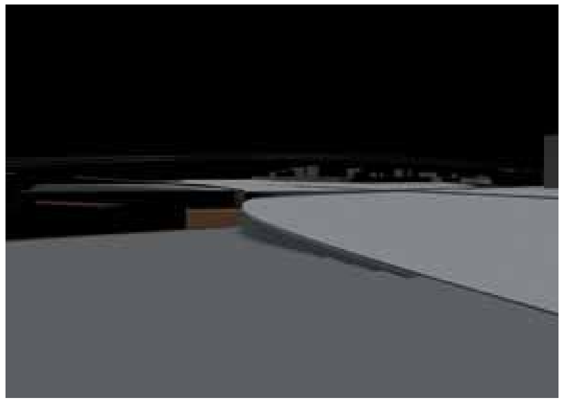
[Portuguese National Jury Report] 'It combines the characteristics of the material with the structural robustness of the arches, both in plan and in elevation, with a three-dimensionality of great lightness that intensifies the continuity of the public space.'

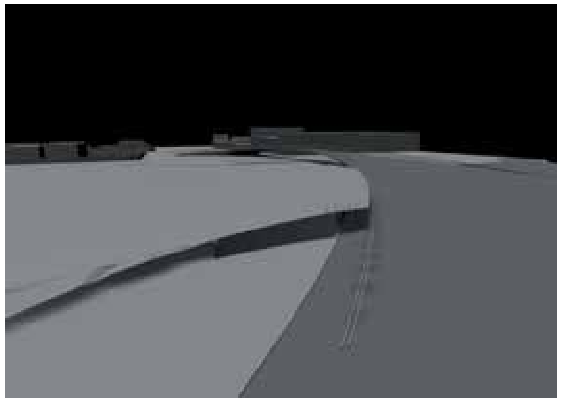


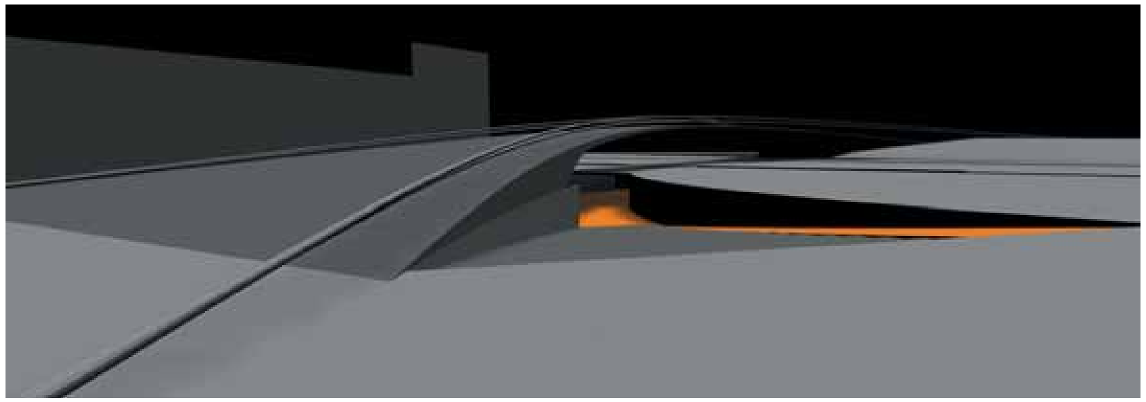








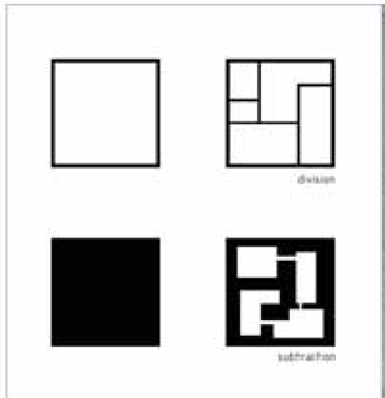




NG319

GERMANY (national nominee)
Sönke Gebken – University Hannover
Nils Nolting – University Hannover

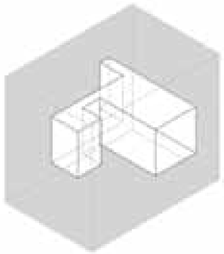
[German National Jury Report] 'The place of contemplation has a minimum of intervention and a maximum of use. The simple presentation has a poetic charm thanks to the use of material. The lime, which is manufactured to cement in the shape of concrete, forms the chain of raw material, intermediate and final product. The possibilities of building in the quarry and forming interior spaces could be realized more consequently.'
(also read: International Jury Comments Curator's Summary)

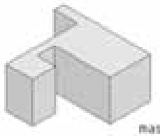


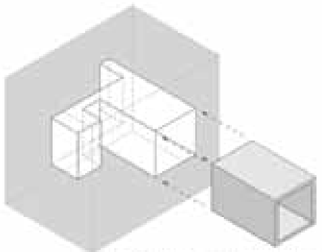
spatial principles


sectional model (excerpt)

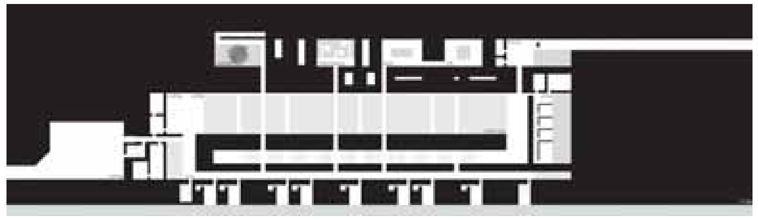
Spatial Principles
'By placing the spatial structure into the mass, spaces are produced not by dividing a volume with walls (like in a conventional building) but by subtracting of mass from mass. This formal principle opens the possibility to think the spaces entirely from the inside, not directly having to relate to a space beside,'

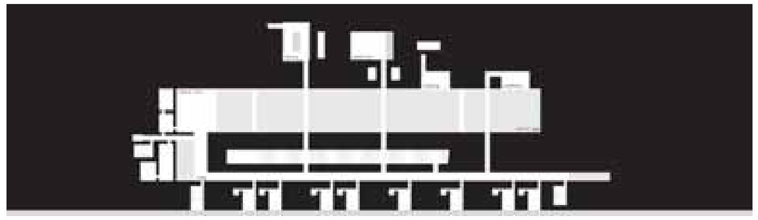

void

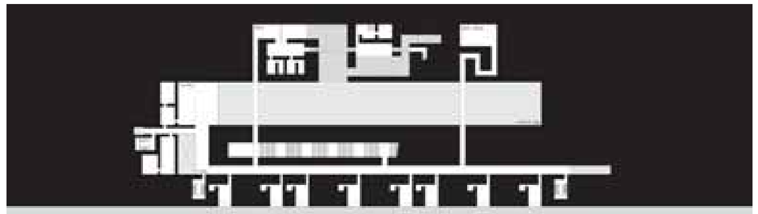

mass of raw material

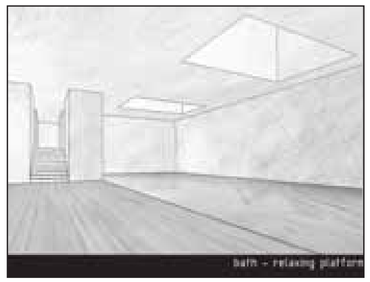

inserting the concrete structure

'The structure is arranged around a central 15-metre-wide and 20-metre-deep gap, on the short sides of the gap the (public and logistic) entrances, and the administrative and serving functions are situated. The long sides of the central gap are connected by wooden footbridges.
On the western side of the gap three levels with private cells are freely arranged in the eastern steep face of the pit with visual contact to the lake. These levels are connected through the major horizontal and vertical circulation.
The mass to the east of the gap contains the spaces of perception. On the top level courtyards with different themes (reading, communication, water, fire) are located. The level below contains spaces of thought (reading, creativity and meditation). Another level below the spaces for the body (the bath, recreational spaces) are arranged. The deeper one gets into the mass the less light that reaches the spaces. The intensity of perception increases.
The sensually most extreme space is a space shrouded in total darkness. The visitor winds himself down into the massive rock until there is no light left and he has to relate to other senses than the visual.'









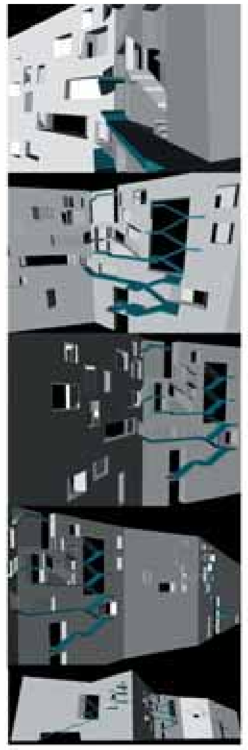
SJ793

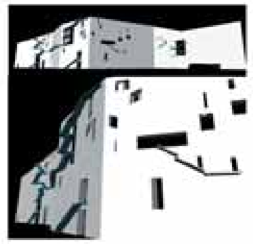
CONCRETE AS URBAN LANDSCAPE

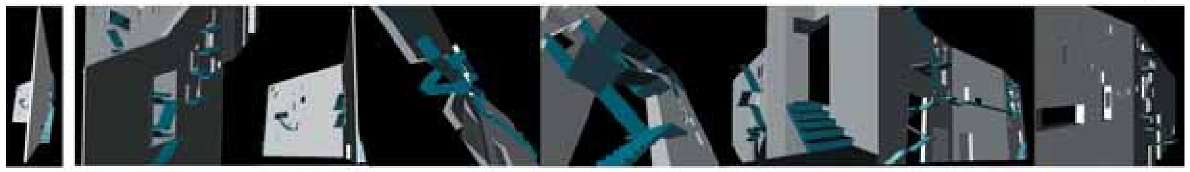
TURKEY (national third prize)
Levent Firat – Istanbul Technical University
Onur Sariyildiz – Istanbul Technical University
N. Onur Sönmez – Istanbul Technical University

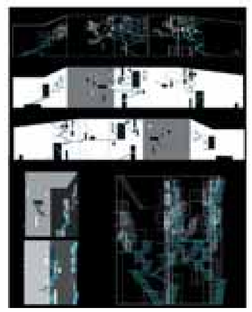
[Turkish National Jury Report] 'This proposal is a search for the material-based limits of concrete. It suggests a wide range of alternative uses for the material competitive to its conventional use. The aim seems to create a wider integration of the material with our daily life by the creation of real and symbolic urban references. Considering the plurality of the urban meanings associated with the material as well as the richness of the representative alternatives, the jury selected this proposal for the third prize.'

'the wall at the end of the city / the edge, the rampart, opacity, the shade
the building: the plaque, folded and carved, the cliff, the bulk, the cave
walk climb hide stay sleep drink live escape'









SM027

TURF SHED ON A MAYO BOG

IRELAND (national second prize, ex aequo)

Simon Cafferty – University College Dublin

[Irish National Jury Report] 'Turf Shed on a Mayo Bog ('components/ process'): unusually among the entries that explored the creation of new components and processes, this physical-research-based entry set out to enjoy some unexpected qualities of concrete by treating it as an elemental material, without exercising control over the final finish. The entry documents the experimental moulding process undertaken, recording how the reed-reinforced research pieces were cast on the bog. The proposal is modest (even if there are doubts about how this rudimentary tilt-up structure could 'float' on top of the bog) and connects with the ancient community tradition of *meitheal*. Although the idea is stronger than the finished result, the jury was sympathetic to the concept of taking a raw field – the earth of Ireland – as a mould into which you might pour concrete, to make a trace which would be left on a structure. We admired its handmade, low-tech quality and how it refused to fetish the surface.'

Formwork

'The structure which contains and moulds the concrete as it gets poured. A considerable amount of work is involved in the construction of formwork (chippies, steel workers, labourers) and yet the end product seems to devaluate it. Integration of concrete and formwork was an initial idea.

Bog

'The fact that concrete takes the shape of its formwork and the mirror image of the surface it rubs up against is a nice idea to work with. My idea was to excavate a piece of ground (in the bog) and use the ground as both formwork and finish for the concrete. Bog / peat is easy to excavate, holds its form well and you can imprint any image you want on its surface. Some of the impressions left on the peat after it has been cut by machine or man were interesting starting points to look at.'

SO124

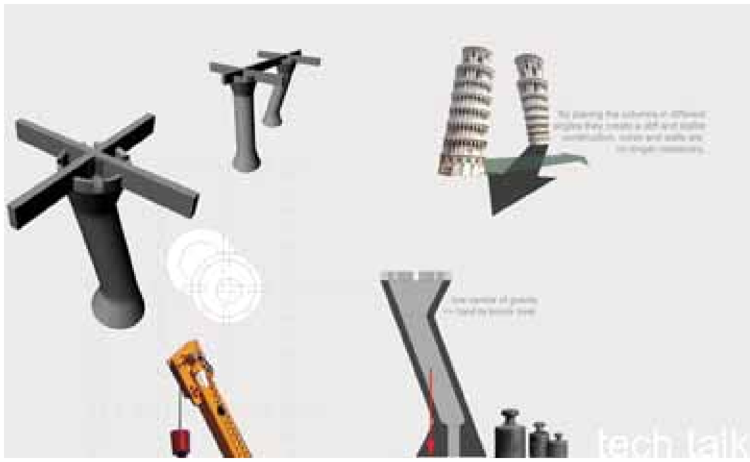
HANGOVER

NETHERLANDS (national third prize, INTERNATIONAL HONOURABLE MENTION)

Niels Verkooijen – Technical University Delft

[Dutch National Jury Report] 'Oversized and twisted columns, with hollow core. The idea is that this column can be mass produced and used individually. The idea of inclined columns is not quite new; slanting or inclined columns were a hype in architecture for some years. The design proposal shows a technical approach, combining the design process with the production and execution processes. The jury appreciates that. It seems to be neglected that the play with the columns results in complex structural situations in the floors. In these structures it is impossible to use precast concrete floors; these have to be produced on site.
The design can be characterized as a fashionable, sexy, decorative idea for columns.'

(also read: International Jury Comments Curator's Summary)

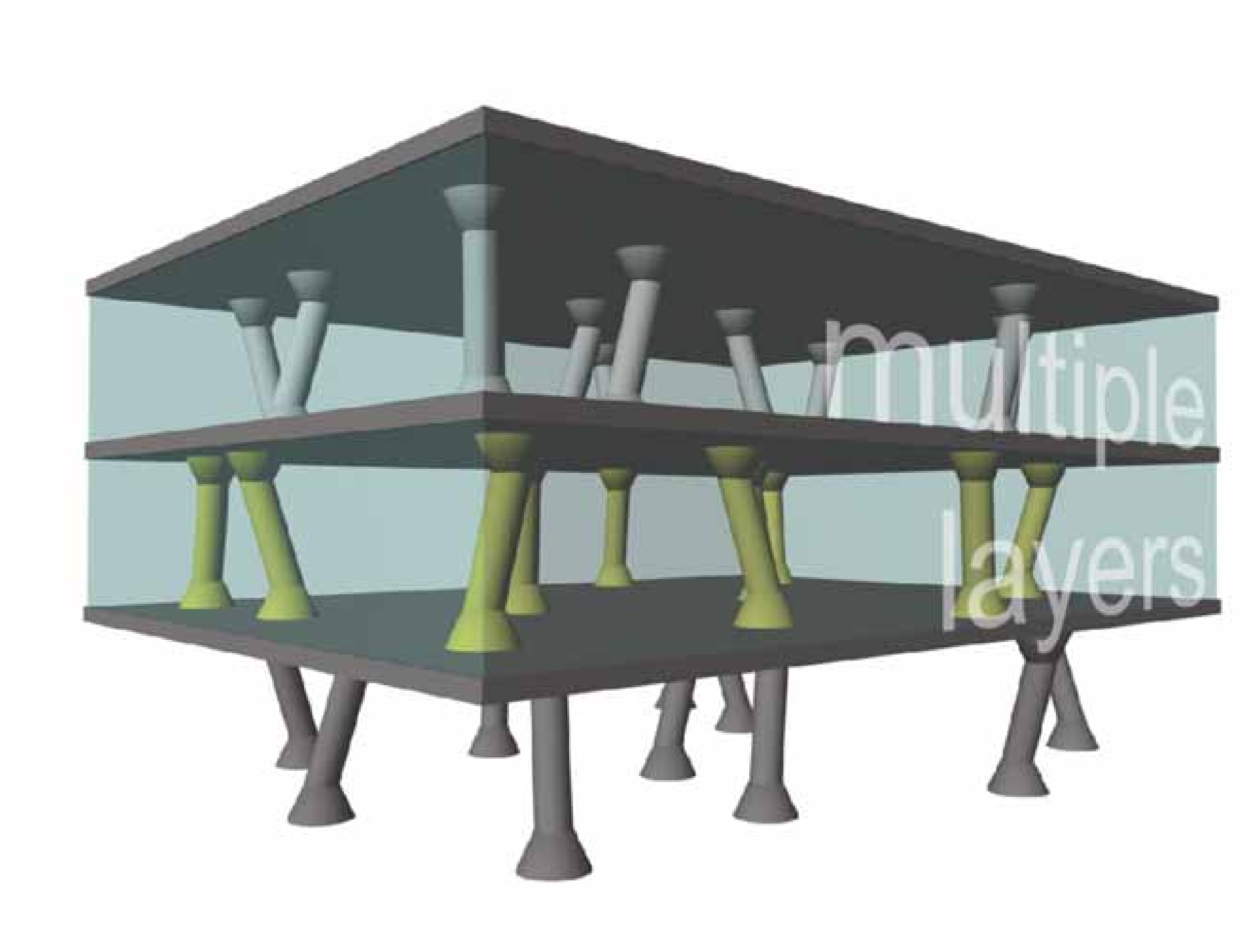


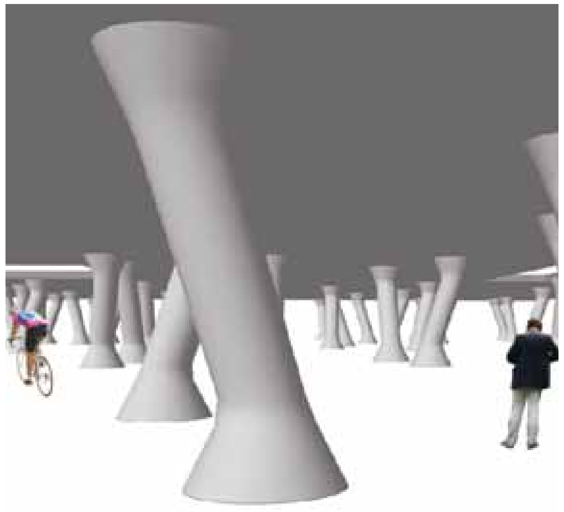
Body & Fluids

'The element is a simple prefabricated column which is oversized so that it becomes independent. This heavy-weight will withstand all sorts of conditions and gets even more resilience because of its twist.

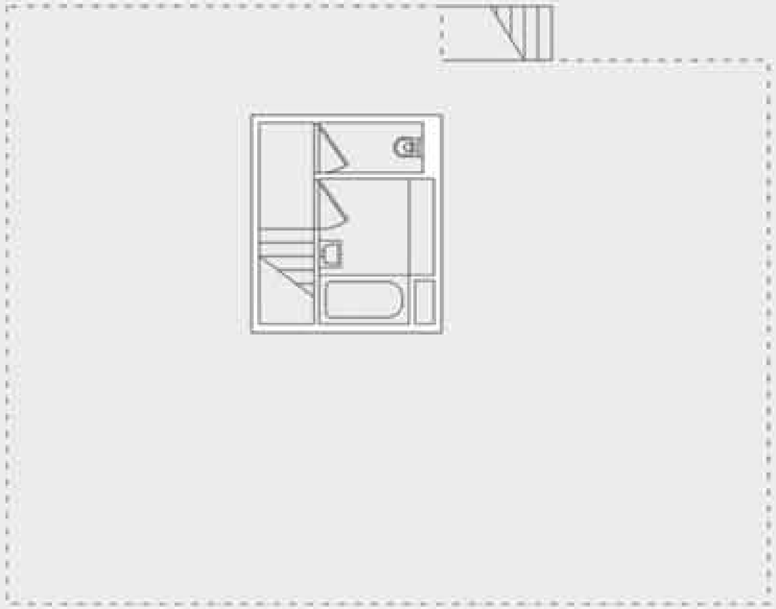
Physical strength; an angle stiffens the construction in one direction, more columns / angles secure the total stability.
Dynamics; every column adds a new direction and they are all playing with each other.
Playful; the little twist in this column makes you almost forget about its serious task.
Flexibility; a column can be rotated in eight different positions, in total this makes uncountable variations.
This will probably result in spontaneous compositions and gives you the possibility to avoid or to hope for those "different" situations.

Inside the columns you will find the technical infrastructure of the building. Water, electricity, data, heating, vacuum cleaner, drain and rain pipe are all transported and distributed through these columns.'

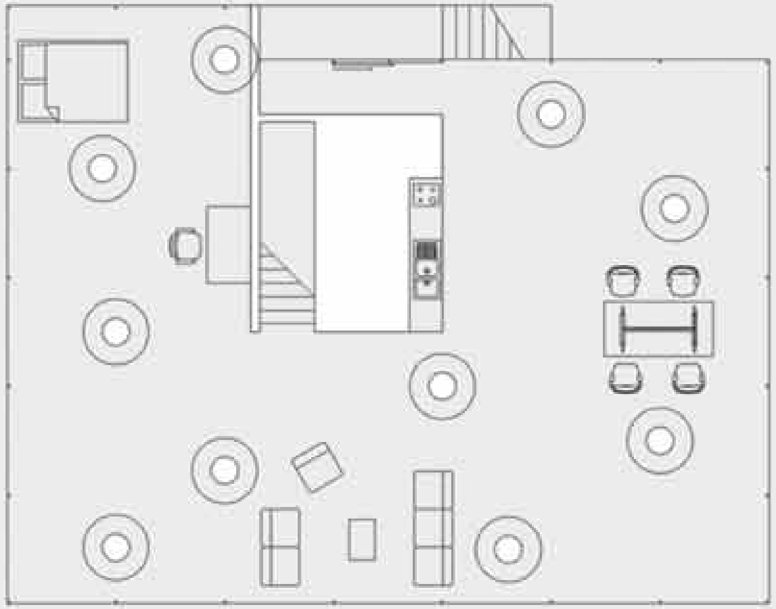




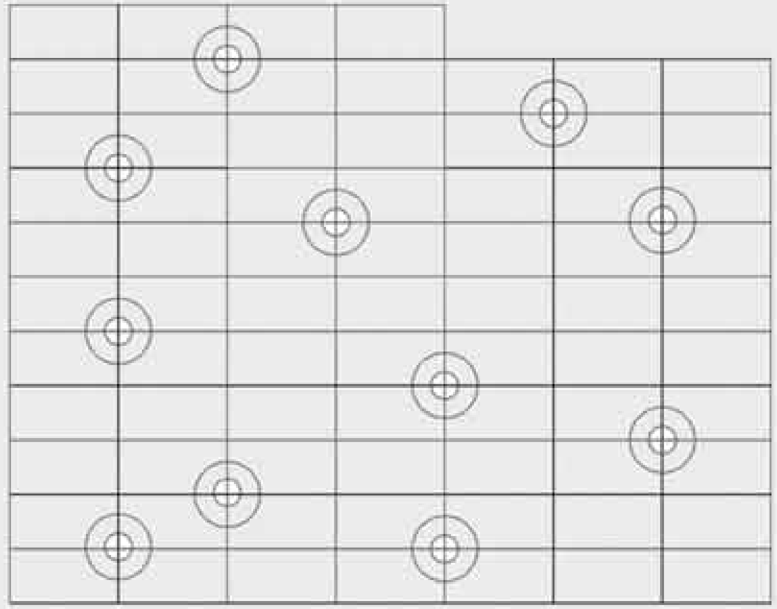
SO124



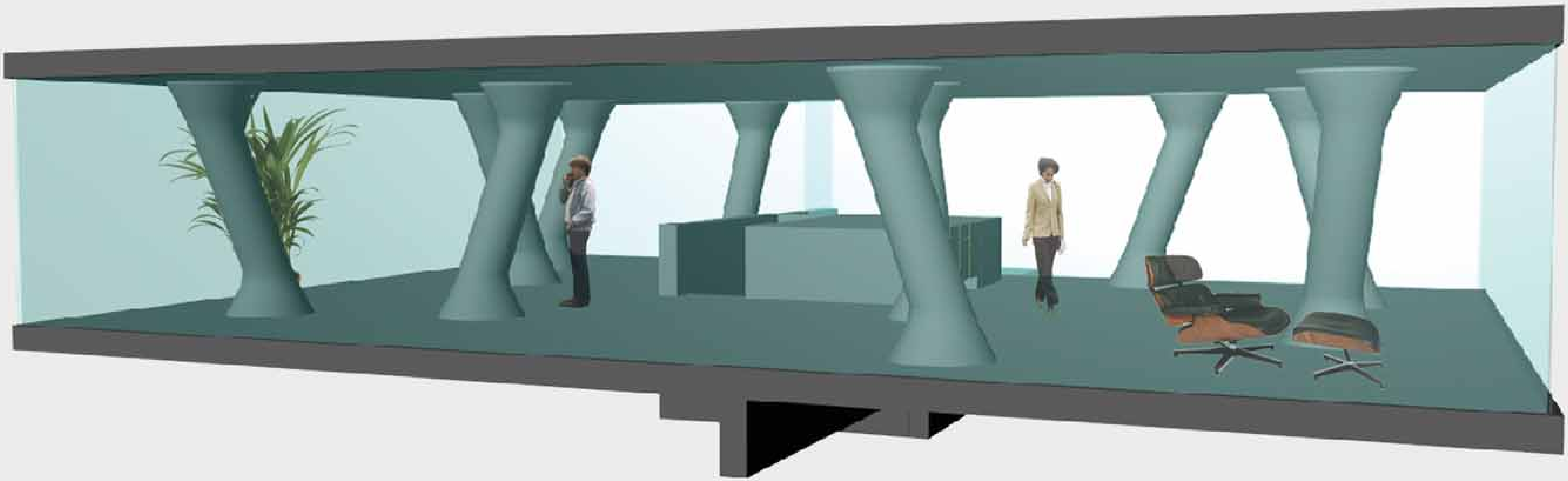
lowered level



main level



roof diagram



TC120

DEVELOPMENT OF NON-DIRECTIONAL SPATIAL SKELETON STRUCTURE

UNITED KINGDOM (national third prize, INTERNATIONAL WINNER)

Il Hoon Roh – Royal College of Art, London

[UK National Jury Report] 'This entry investigated the capabilities of a non-directional space frame structure in order to achieve programmatic cellular growth of a building. The entry looks at the possibility of using inflatable pneumatic moulds to create the structure, thus forming space or rooms.

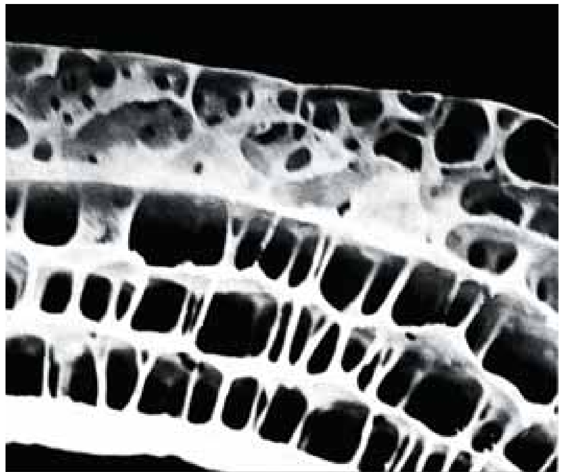
The result is the development of a wide-span reinforced concrete structure with optimized mass. The concrete-filled intersections produce a skeletal structure.

Five different sized pneumatic moulds are proposed, this idea deviating from a more conventional three-dimensional network of bubbles, and providing more flexibility. A frame is placed around the bubbles and they are packed tightly to give a stable configuration at a low energy level.

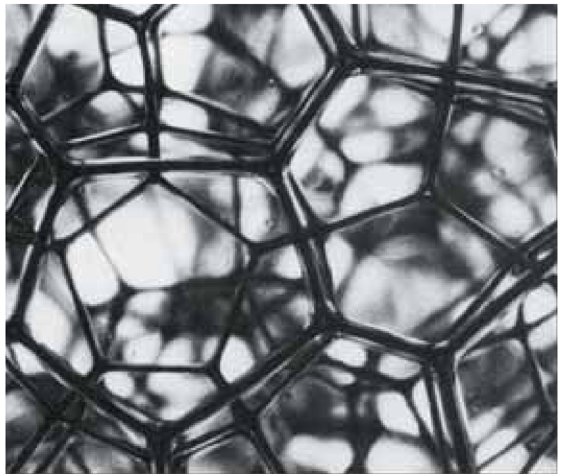
The pneumatic mould structure distributes applied forces three dimensionally like a composite material and not via a single independent element. When the structure is duplicated and layered on top of the original structure rigidity and stability are increased.

A two-dimensional joining structure is then used to link the existing elements, functioning primarily to transfer the loading stresses throughout the structure but also to act as a ventilation and utilities connection shaft.'

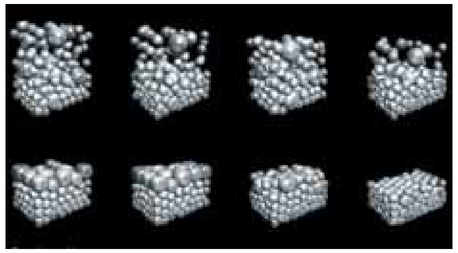
(also read: International Jury Comments Curator's Summary)

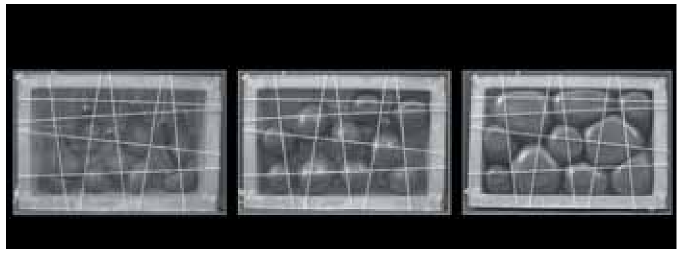


Enlarged section of the skull of a bird



Plastic foam

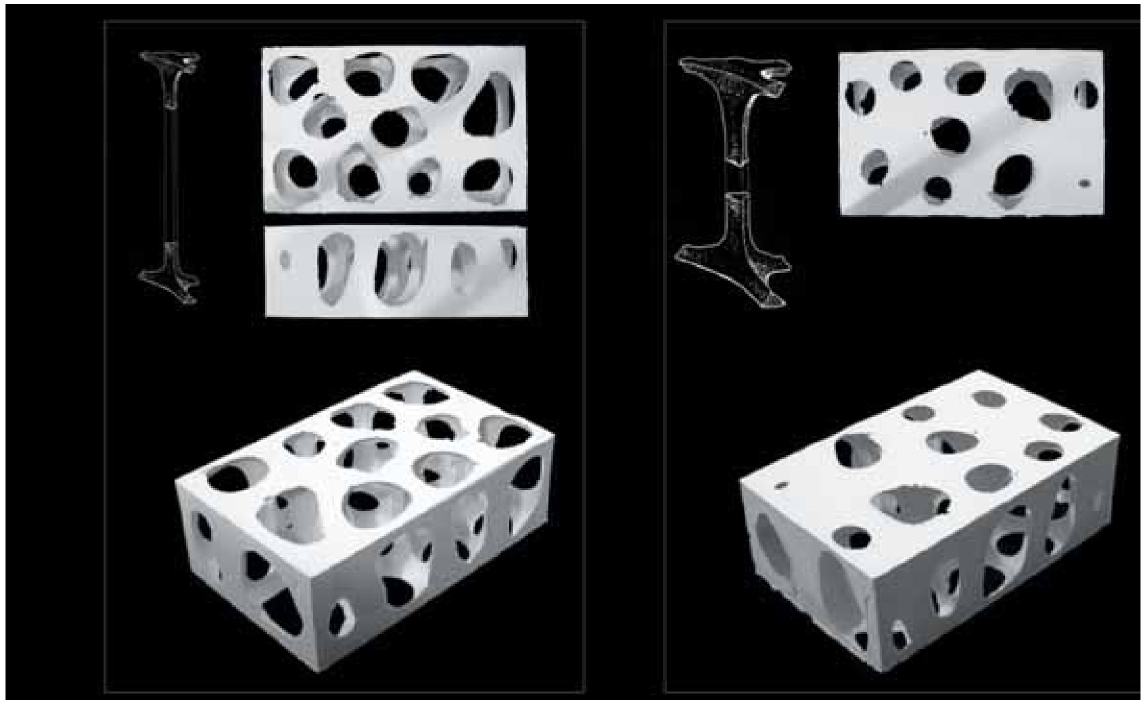




Experiment 01

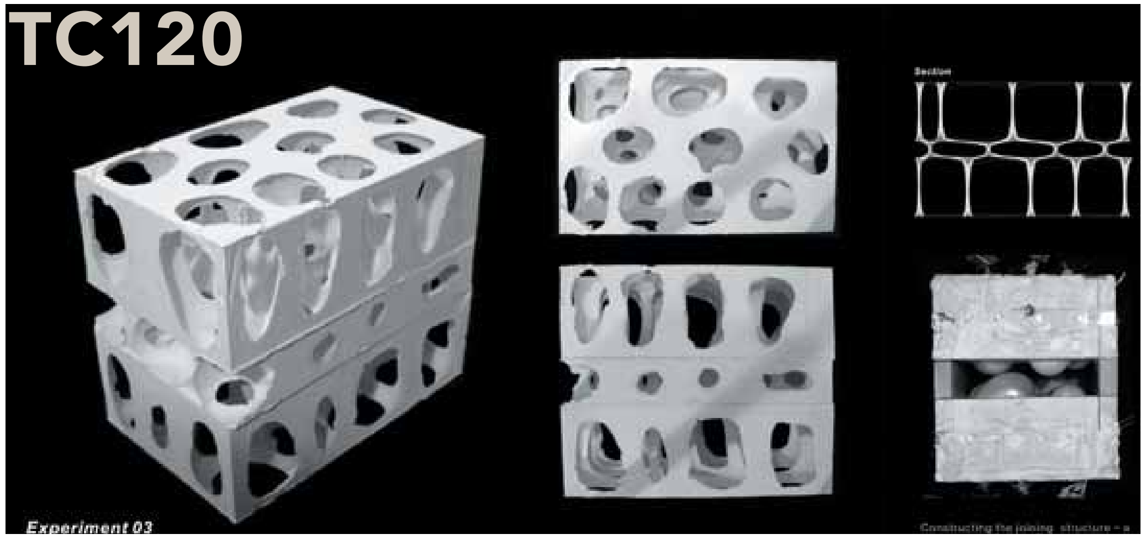
'To meet the need for spatial differentiation five different sized pneumatic moulds were used. This deviates from the ideal three-dimensional network of bubbles of equal size. Therefore it means that little control can be exercised over the x, y and z planes of the space created. The solution to this is to apply a frame around the bubbles to control the height, z, and control the x and y direction by the inputted volume of the bubble, thus controlling the resultant floor area.

The pneumatic mould structure displays geometrical properties of a non-directional space frame structure. They distribute applied forces three dimensionally like a composite material and not via a single independent element. When the structure is duplicated and layered on top of the original structure, rigidity and therefore stability is increased considerably.'



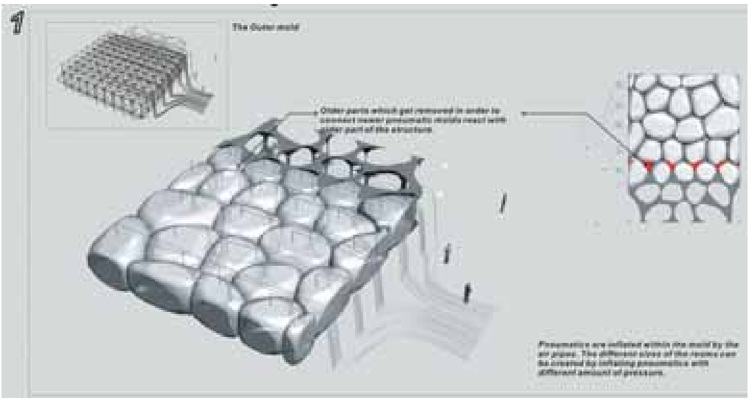
Experiment 2

'The pneu is fitted into a mould, then inflated and cast. The space between the pneus is filled with concrete, thus creating a column or a spatial skeleton structure of fixed height. The lateral pneu walls assume the functions of the connecting elements between outer and inner shells. The lateral boundary layers of pneus are held under tension between the inner and the outer boundary layer. It has the function of a truss. Each lateral pneu wall is shared by the two neighbouring pneus. It could be seen as a T or I beam because these walls have the function of beams. The thickness of the columns can be adjusted by applying different amounts of pressure.'

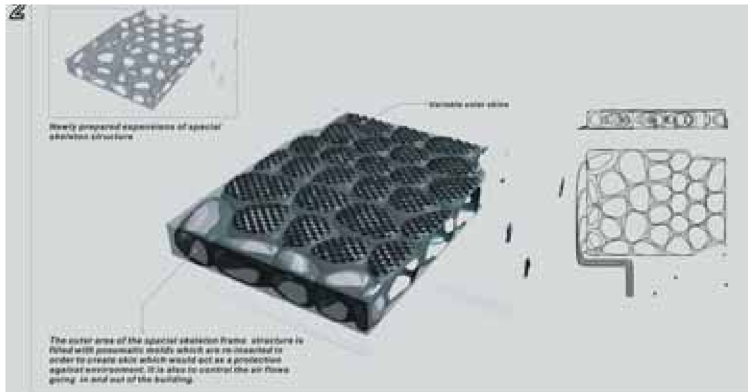


Experiment 3
'To maintain the properties of non-directional special skeleton-frame structure, an adjoining structure is constructed. A new set of pneumatic moulds is placed between the two layers and cast. From the construction point of view, this joining structure is a two-dimensional constructional element, having the function of a truss.

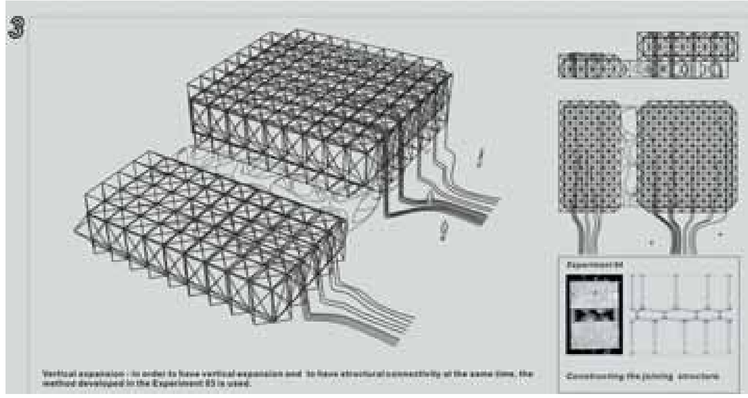
Construction Sequence
Pneumatics are inflated within the mould by the air pipes. Different sizes of rooms can be created by inflating pneumatics with different amounts of pressure.

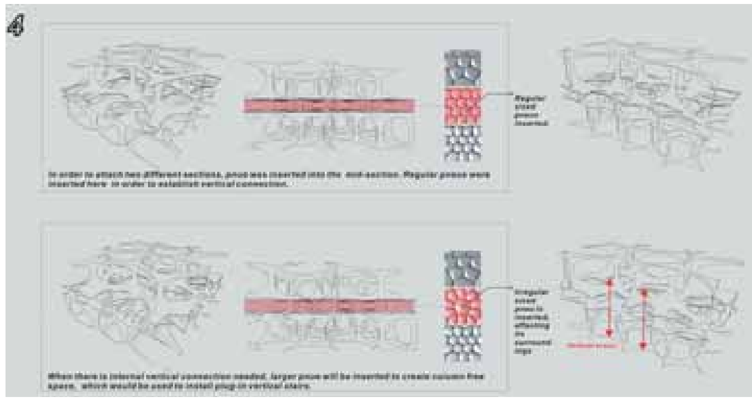


The outer area of the spatial skeleton frame structure is filled with pneumatic moulds which are reinserted in order to create skin that acts as a protection against environment.

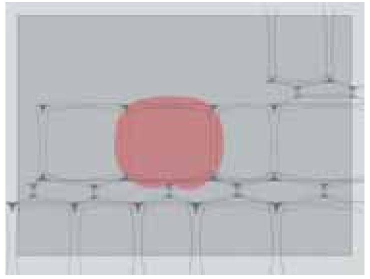


In order to have vertical expansion and to have structural connectivity at the same time, the method in Experiment 3 is used.

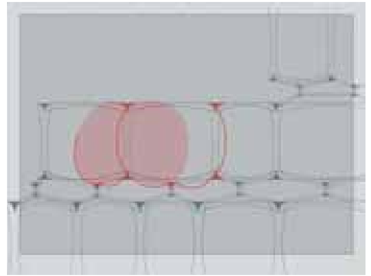




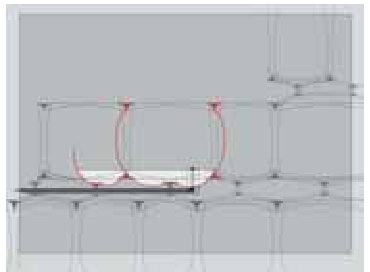
Manufacturing Process



Pneu mould is re-inserted into the spatial skeleton structure then inflated

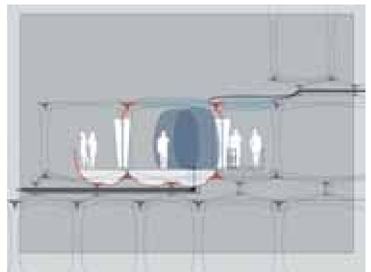


Pneu mould is cast with composite material by being sprayed on the outer surface



Service pipes are connected. Foams will be sprayed to create the floor surface.

Plug-in structures will be placed



Spaces are divided further, by reinserting the pneu moulds and the casting process is repeated according to the needs of the inhabitants.

TG360

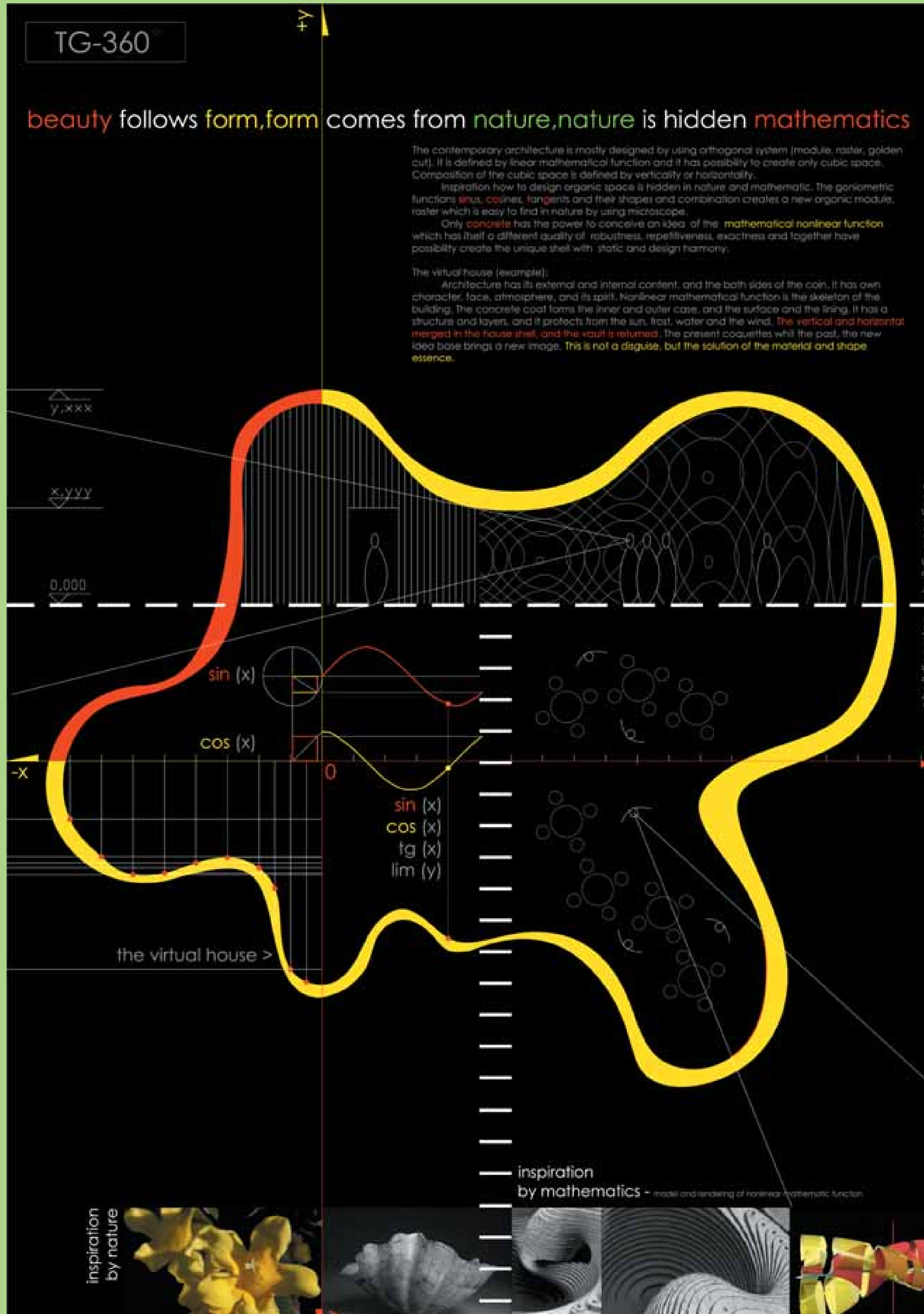
BEAUTY FOLLOWS FORM

SWEDEN (national first prize)

Sebastian Nagy – KTH, Stockholm

[Swedish National Jury Report] 'The nomination illustrates the possibilities for creating highly versatile concrete structures inspired by living organisms and mathematical exactness and beauty. The contribution is also inspired by the non-linear forms of living creatures that, driven by the evolutionary process, adapt over time to their environmental circumstances. The presentation demonstrates in wall and roof plans and sections how the strength and potential of concrete has been exploited to create innovative design idioms entirely consistent with the precision of today's production technology.'

'Beauty Follows Form, form comes from nature, nature is hidden mathematics.
Contemporary architecture is mostly designed using orthogonal systems (module, raster, golden cut). It is defined by linear mathematical functions and it has possibility to create only cubic space. Composition of the cubic space is defined by verticality or horizontality.
Inspiration for how to design organic space is hidden in nature and mathematics. The goniometric functions sinus, cosines, tangents and their shapes and combinations create a new organic module, raster which is easy to find in nature by using microscope.
Only concrete has the power to conceive an idea of the mathematical non-linear function which has itself a different quality of robustness, repetitiveness, exactness and together have a possibility create the unique shell with static and design harmony.'

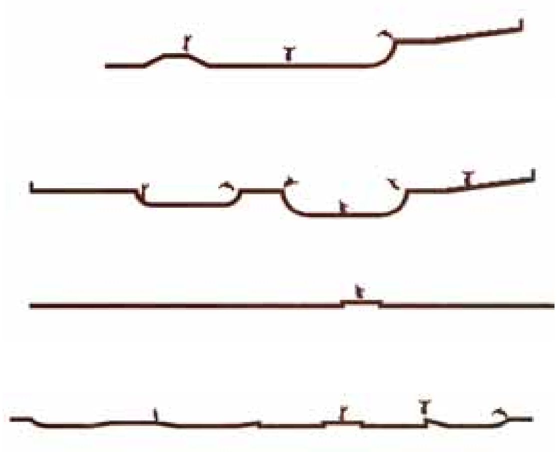


UN981

ROBUST HERITAGE

BELGIUM (national nominee)
Kristof de Bonte – Vrije Universiteit Brussel
Tom Broes – Katholieke Universiteit Leuven

[Belgian National Jury Report] 'This project can be understood as a genuine reflection on the reinterpretation and reuse of existing concrete infrastructure with regard to the evolving needs of the urban population. The notion of robustness is clearly applied to this question, both in terms of design and programme. The project takes advantage of the existing need for a skateboard facility to introduce an urban programme on the site of the tunnel roof of a Brussels train junction. While the definition of this programme remains too vague, the jury appreciates the strategy of reverse appropriation (public space appropriated by skaters and re-appropriated by an urban programme) at work in this proposal.'



Building Square Axis
'In modern cities robustness can be read in three layers: the built space, the common square and the mobile axis. The built space is enduringly robust by its conversion on a long term. Squares enable cities to generate immediate flexibility: concerts, markets, manifestations…
The axis forms the somehow timeless connection between building and square.

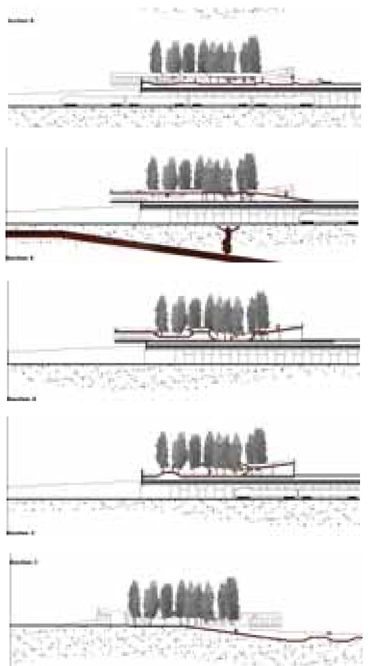
This project is robust in all three ways. It is building, square and axis at the same time. In the project the three layers interact and complement one another. In this way, the sum of these three layers results in an urban robust entity. As the pictures below show, this project can be seen as such a robust entity.'

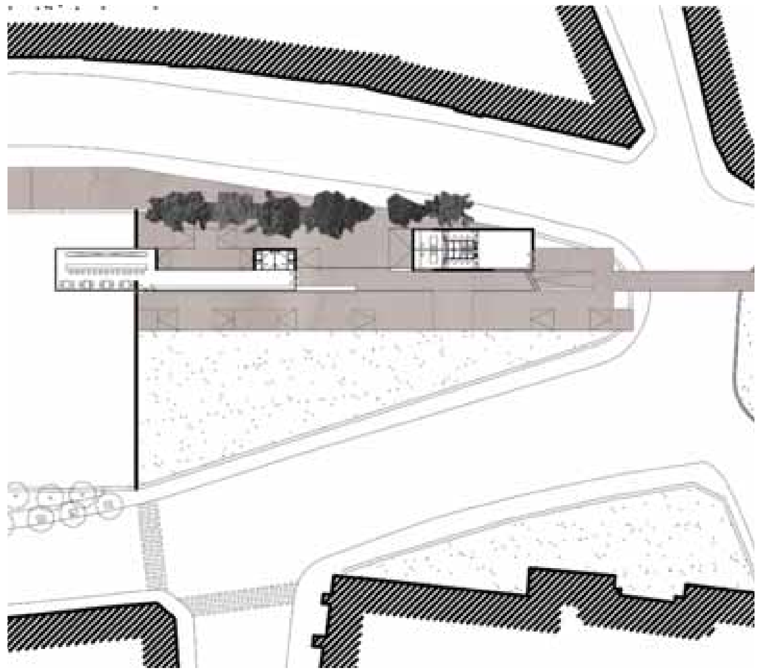
Robust Use
'The project is first of all designed to be an urban skate park. Designed as a robust entity rather than a traditional mono-functional skate park. As embedded in the definition of a robust entity (building + square + axis = robust entity) a differentiated use became a logic consequence.'

Concrete
'Concrete here is considered as the ultimate material to physically merge the three layers (building, square, axis) and make them work together as one robust urban entity. It is in fact through the unique formal possibilities of concrete that this robust entity is conceived by freely folding, thickening and stretching six strips. Being robust and flexible in three fundamental urban ways, the project itself reaches the same level of robustness as the railroad tunnel that supports it.

Another property of concrete that we use is erosion. Tracks of oxidation will add flavour to the identity of the project. By using future processes as a strategy, the robust entity will be embedded in the grey history of its railroad surroundings.

In this way, concrete is not only used as some material, but as a meaningful urban strategy.'





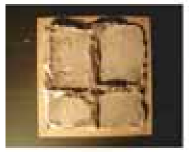
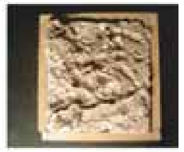
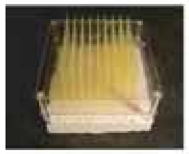
UW010

SURFACE ROBUSTNESS FROM SURFACE CONDITION
UNITED KINGDOM (national second prize)

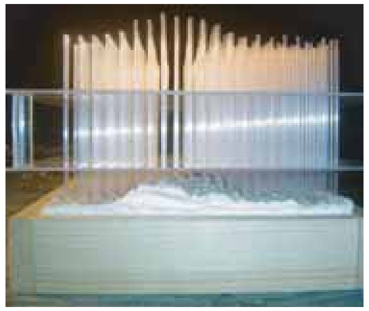
John Hutchinson – University of Westminster
Thomas Kilvert – University of Westminster

[UK National Jury Report] 'This entry shows how surfaces that receive little attention can be elaborate and wonderfully diverse.
The scheme explores surface robustness, vitality and durability that can be expressed through design studies of surface quality intricacies. New morphologies incorporating original surface diversities are expressed through repeated modules. These lead to determination of spatial conditions in relief.
The understanding of surfaces and their diversity can be applied to developments in concrete surface of walls, sofits and claddings, advancing their design possibilities.
The surface casting process has been started by free-form casting of concrete; modular basis 3D pin machines can be employed to form new surfaces as shown.'
(also read: International Jury Comments Curator's Summary)



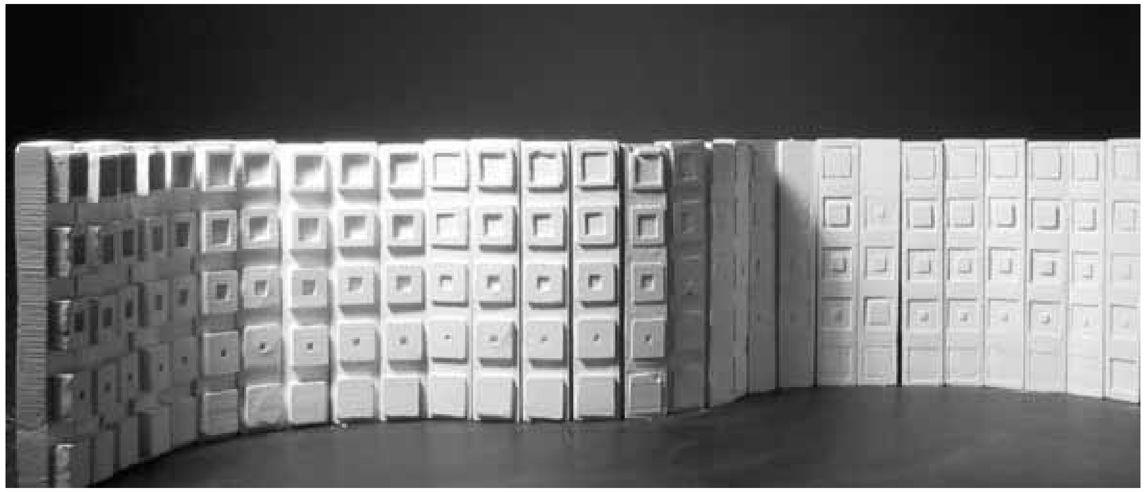





Free form surface casting showing elaborate diversity in surface topography.



Surface translation machine creating Cartesian grid to develop and advance new surfaces.

Translated casting of surface showing patterns advanced from regulated formed translation.



'Surface robustness, vitality, durability can be developed and expressed through examination and understanding of surface quality intricacies. Surface robustness is translated and configured to form new morphologies incorporating original surface diversities. This can be repeated and developed to determine spatial parameters.

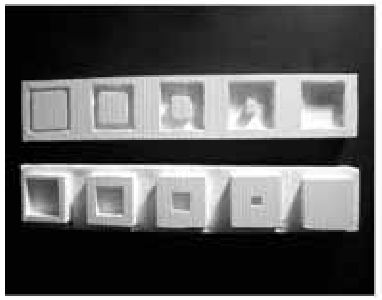
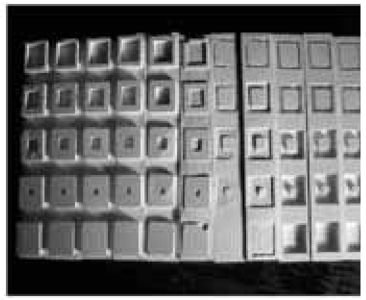
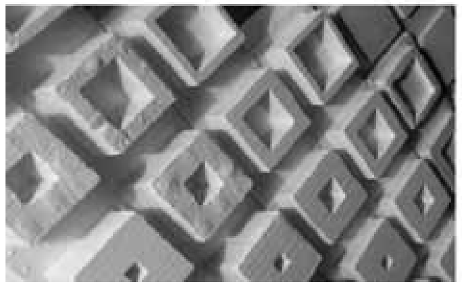
Using a process of experimentation with pattern to create meaningful and relevant three-dimensional systems, the following results were achieved. The idea is that through a playful open process can be reached an integrated system where the structural integrity, form, and surface condition are all harmonious and homogeneous.

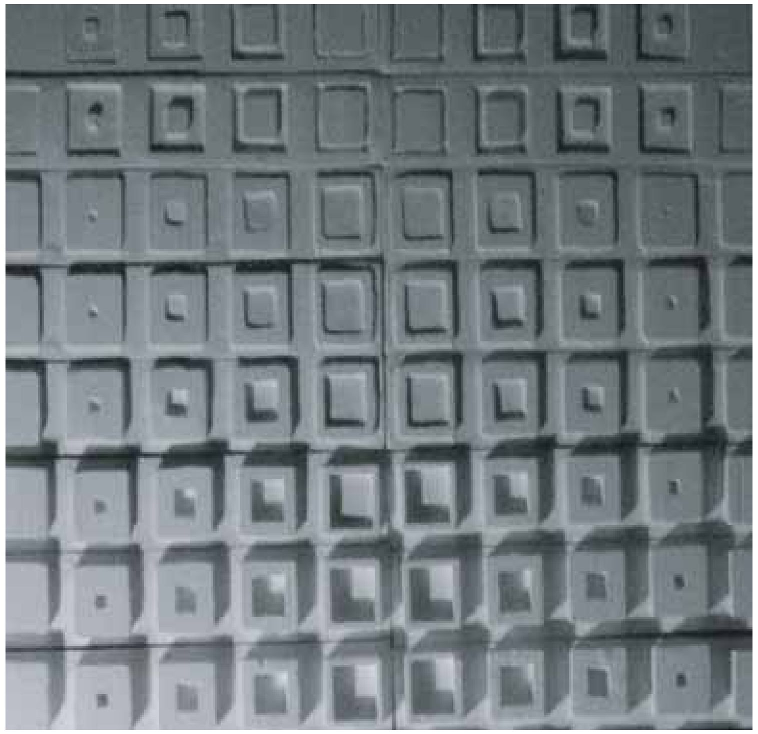
Through an initial study of surface abstraction the principle beginnings of surface translation can be developed. These newly free-formed surface castings highlight the vast diversity held within surfaces often thought of as flat and featureless. A subsequent understanding of these new surfaces can be developed through use of three-dimensional pin machines to translate the original castings. This process regulated and 'modulised' the castings to form new and more highly abstracted surface units.

By rationalising these surfaces, a rigorous examination of surface qualities and spatial relationships can be undertaken. Tiled blocks with standard motifs of varying heights are positioned in a controlled manner so as to create an undulating surface. These modules can then be utilised as building blocks which are configured in such a way as to create new flowing, more organic, three-dimensional forms from standard, orthogonal tiles.

This understanding of surfaces and their diversity can be ideally applied to the development of concrete structures and surfaces advancing varied design possibilities.'



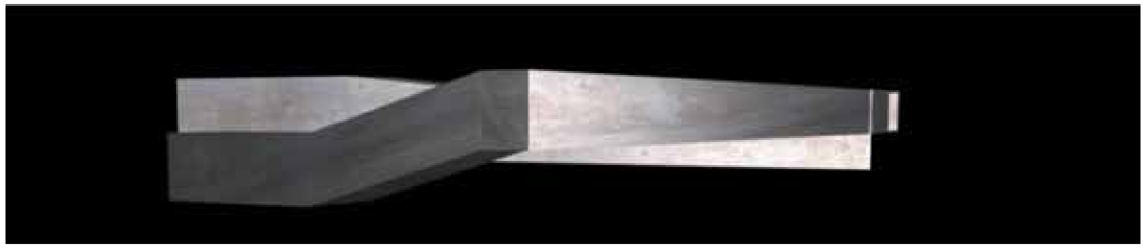


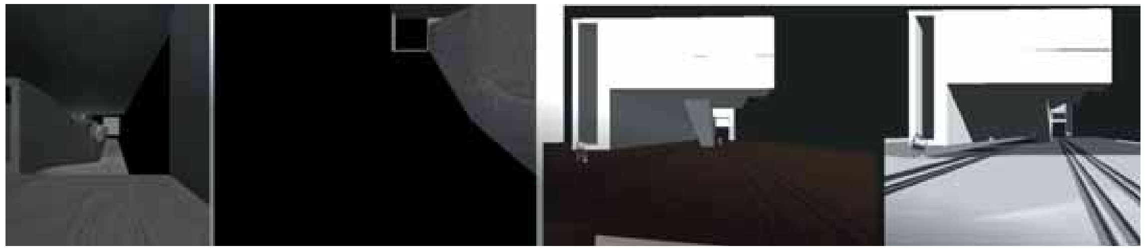
VF112

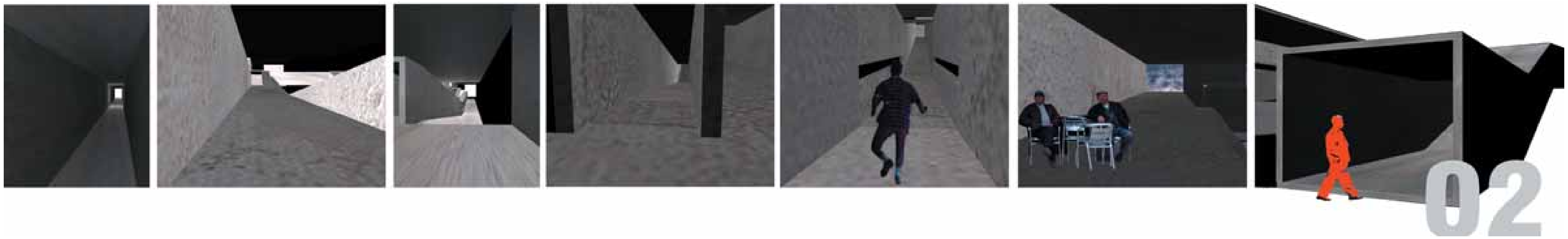
PORTUGAL (national nominee)
Tiago Furtado Cabeleira – Universidade Lusiada de Lisboa

[Portuguese National Jury Report] 'An architectonic form of continuity totally adapted to concrete, exhibiting a poetic contradiction between the massive form of the building and the lightness of its standing, at the same time providing a transversal crossing organized longitudinally.'

'Lines that generate fragments of a same territory, of different existences and errant courses of the Man, who instinctively looks for the essence of the other side of the life (limit).
Distant looks, fugacious over the void, in the impossibility of reaching it.
Expression tagged by the wrinkles of a life. Deep scars of a territory, where the vacant shadows, of the other side, attract the natural curiosity of the human existence.
Being the territory we live in, truly mutilated by deep segregating scars.
As an object of study, an existence of a railroad, just a physical boundary of a territory impassable to Man.
It comes to mind to intervene over that same frontier, making it habitable. In limit, all the extension of that same line will be utilizable by Man.
It becomes clear, that the human behaviour over the opposite limits, of that same line should be changed as less as possible.
Through the existence of a structure / spatial structure will necessarily have just one contact point with the ground.
Huge paradox?
The spatial construction of a line just composed by points.
It matters to me just the Robustness of Material, as a physical element that defines a way of inhabit.'



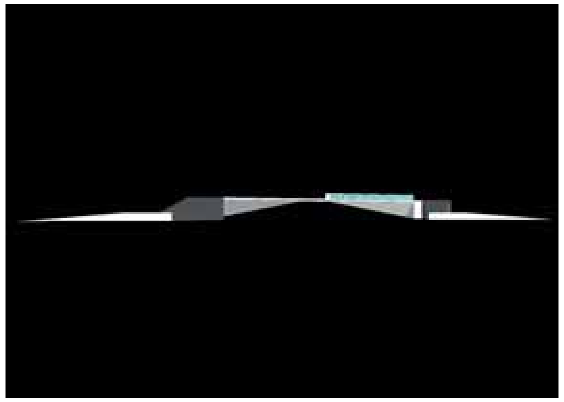
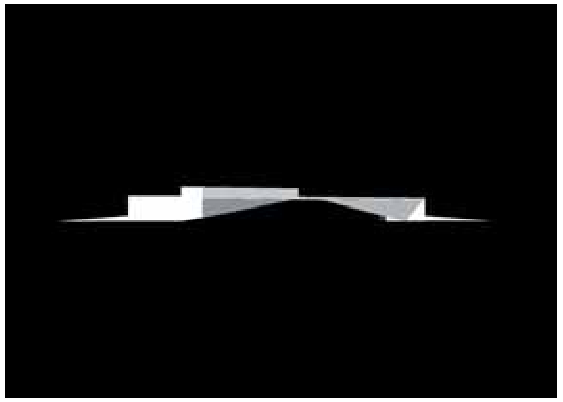
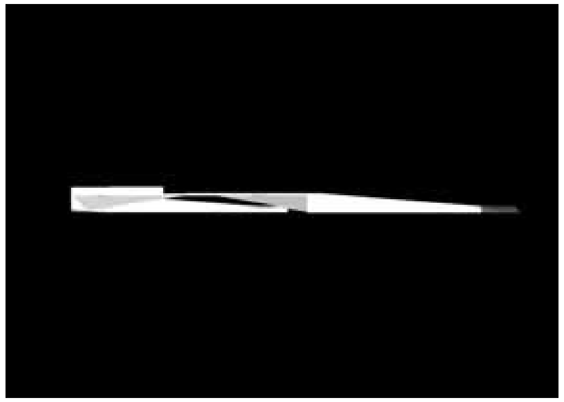
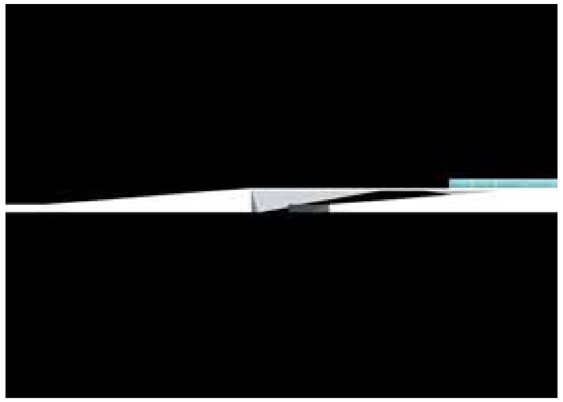
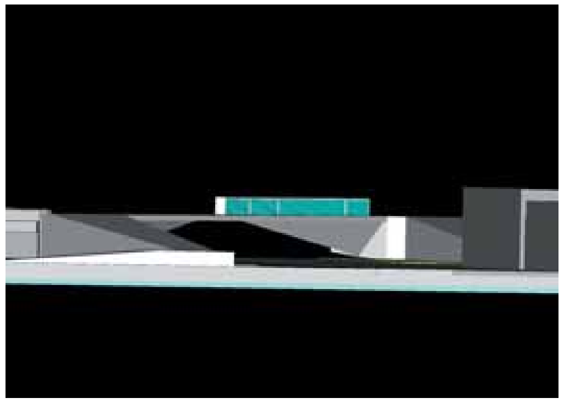
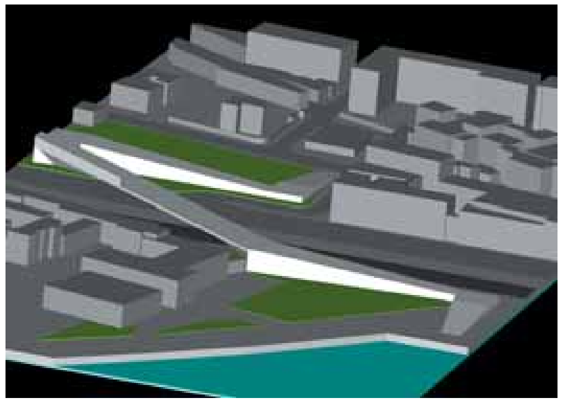
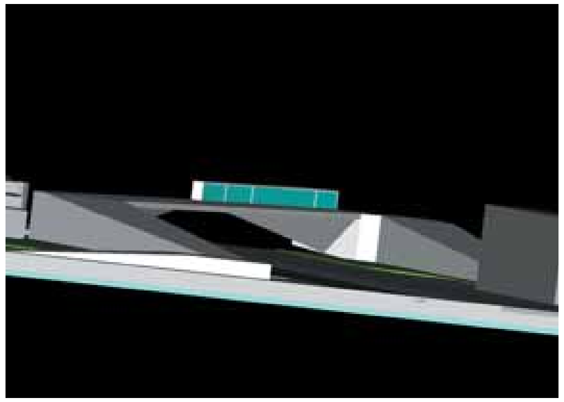
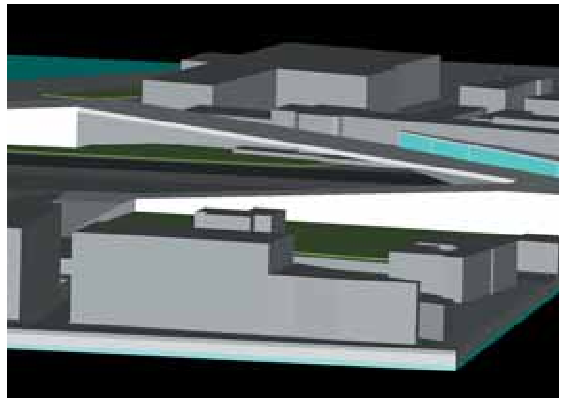
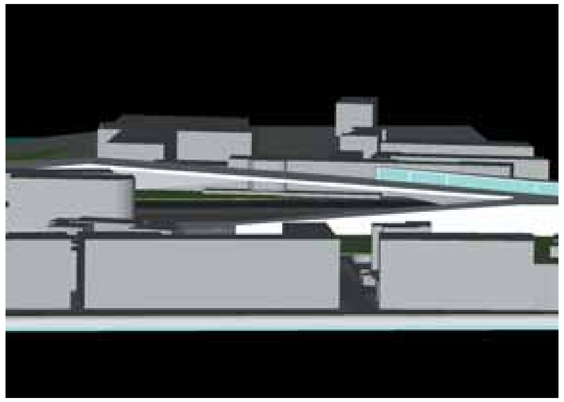
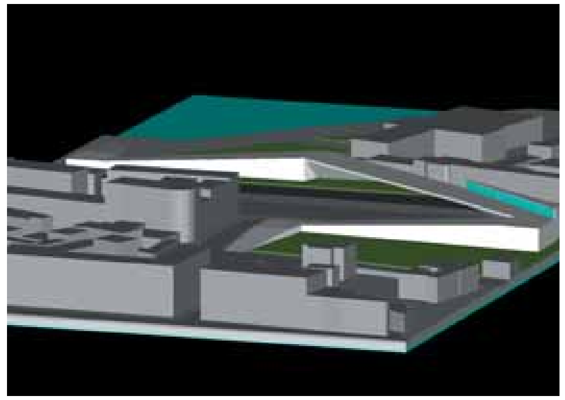
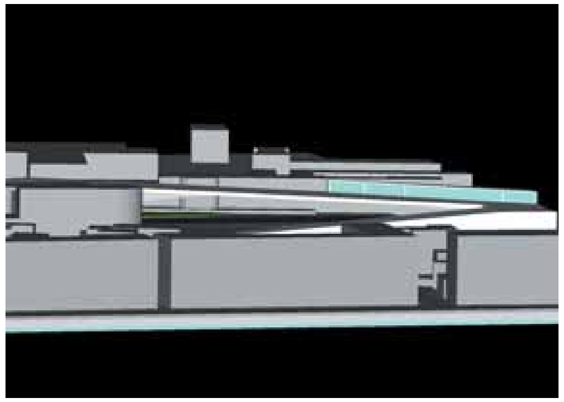
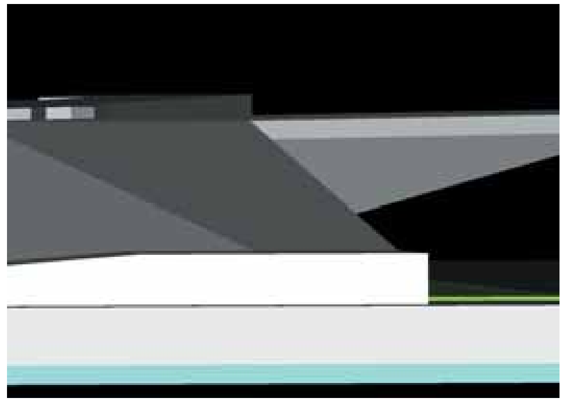
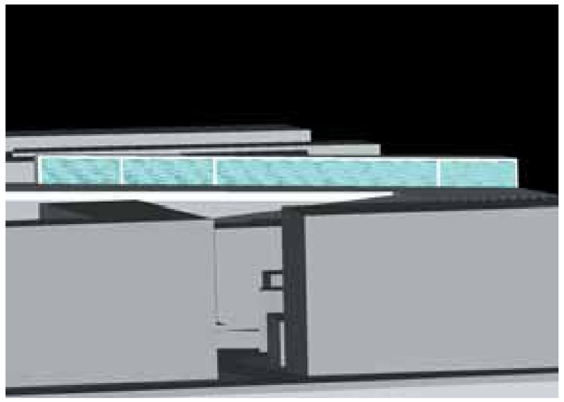
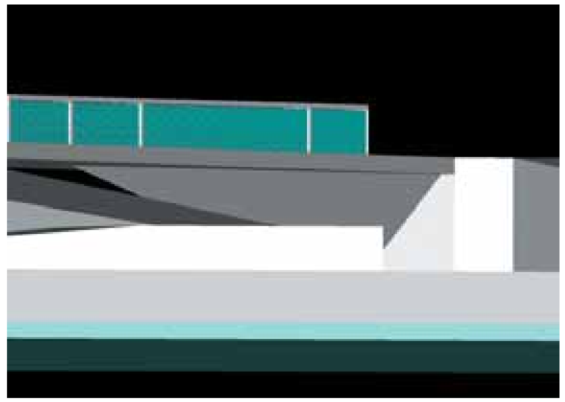




WZ331

PORTUGAL (national nominee)
Luis Pedro Ferraz Marques – Universidade Lusiada de Lisboa

[Portuguese National Jury Report] 'This entry responds to the brief of the competition with great simplicity, creating a walkway of great expressiveness and structural efficiency.'

73

INTELLIGENCE AFTER THEORY

MICHAEL SPEAKS

If one were to write a history of architecture since May '68, noting in particular the role the events that summer played in shaping contemporary practice, it would begin by recounting the passing of philosophy and the rise of 'theory'. By theory I mean that set of mostly French, German and Italian philosophical tracts that arrived in the US in the late 1970s through departments of comparative literature and were disseminated to the American university system as a wonderful new mode of contemporary thought. Theory was detached from its continental origins and replanted in the US where it took on a lighter, more occasional existence. Theory was portable – it could be attached to almost any field of study, film, literature, anthropology, even architecture. Theory carried all the punch of philosophy without the windy German preambles and recondite French qualifications, without, that is, years of study, political affiliation or deep knowledge. Theory was a weapon of the young, the post-68 generation, wearied by the morality and slowness of their elders who seemed so untheoretical whether they embraced or rejected theory. Theory was fast philosophy and it made its way through various sectors of the US academy in the 1970s and 1980s and arrived to architecture, late, as Mark Wigley has so famously and so frequently pointed out.

The shift from philosophy to theory was especially important for the vanguard architects whose work and writing came to dominate scholarly journals, school curricula, and indeed much of what passed for intellectual discourse and debate in architecture from the 1970s until the late 1990s. Whether articulated in the form of Tafurian or Frankfurt school analysis or Derridean deconstruction, these theory-inspired vanguards asserted the impossibility of affirmatively intervening in a world dominated by capitalistic and/or metaphysical oppressors. Continuous critique and resistance instead guided their resolutely negative practices. Moreover, while they challenged modernism's utopian manifestos as naïve and deterministic, theory vanguards nonetheless retained modernism's belief that, as Colin Rowe might put it, word guides form. This occurred most definitively in Deconstructivist Architecture, an exhibition at MoMA (1988) that paired Deconstruction with Russian Constructivism, and which dominated the 1970s, 80s and 90s as theory became the 'word' that directed the development of vanguard 'forms' and vanguard practices alike.

But as the 1990s drew to a close, theory-vanguardism began to wither as new architecture practices better suited to meet the challenges issued by globalization arose to claim the mantle of experimentation that the vanguard, whether in philosophical or theoretical guise, had so long held. Identified as post-critical, fresh, and ideologically smooth, these practices embraced much of the emergent, market-driven world their theory-hamstrung predecessors held in contempt. Two features, in particular, distinguish these new practices. The first is the pursuit of innovation. Management thinker Peter Drucker has drawn an important distinction between problem solving and innovation that many of these new practices have taken to heart and that architects in general would do well to better understand. Problem solving, Drucker argues, simply accepts the parameters of a problem given, in the case of architecture, by the client. The designer is then to work within those parameters until a solution to the problem is reached, a final design. Innovation, Drucker tells us, works by a different, more entrepreneurial logic where, by rigorous analysis, opportunities are discovered that can be exploited and transformed into innovations. While problem-solving works within a given paradigm to create new solutions to known problems, innovation risks working with the existent but unknown in order to discover opportunities for design solutions that could not have been predicted in advance.

Related to this, many of these fresh offices have a radically different valuation of knowledge based on the efficacy for getting things done rather than on truth content. Drucker has also argued that the accession of modern capitalism to world system status was enabled by a fundamental change whereby knowledge was no longer concerned with philosophical or religious truth, but with doing, with action. Knowledge was applied to tools in the first, industrial period of capitalism. As Drucker suggests, however, a second phase of this transformation occurs after the Second World War in which knowledge is applied not only to tools, but in addition, knowledge is applied to knowledge itself. This transformation ushered in the management revolution and signalled the emergence of what Drucker calls 'the knowledge society', a post-capitalist paradigm enabled by globalization. Taking a more pessimistic view of what they prefer to call the 'society of control', Michael Hardt and Antonio Negri, authors of *Empire* (2000), the highly acclaimed neo-Marxist study of globalization and politics, nonetheless agree with Drucker's assertion that the new economic order ushered in by globalization is knowledge-based. Though states still exist as filters of power and control, Hardt and Negri argue that real command and control is now in the hands of mobile and constantly evolving global organizations free from national obligation to roam the planet in search of affiliations that provide competitive advantage. No longer stored in banks of metaphysical truths, today knowledge is manifest as intelligence used to manage these organizations in a world where remaining competitive is often a matter of life and death. As Hardt, Negri and Drucker seem to suggest, the great ideas of philosophy and theory have given way to the 'chatter' of actionable intelligence. Philosophical, political, and scientific truth have fragmented into proliferating swarms of 'little' truths appearing and disappearing so fast that ascertaining whether they are really true is impractical if not altogether impossible. No longer dictated by ideas or ideologies nor dependent on whether something is really true, everything now depends on credible intelligence, on whether something might be true.

If philosophy was the intellectual dominant of early 20th-century vanguards and theory the intellectual dominant of late 20th-century vanguards, then intelligence has become the intellectual dominant of early 21st-century innovators. While vanguard practices are reliant on ideas, theories and concepts given in advance, intelligence-based practices are more entrepreneurial in seeking opportunities for innovation that cannot be predicted by any idea, theory or concept. Indeed, it is *design intelligence* that enables these practices to innovate by learning from and adapting to instability. The freshest of these new practices are thus more concerned with the 'plausible truths' generated through prototyping than with the received 'truths' of theory or philosophy. Plausible truths offer a way to quickly test thinking or ideas by doing, by making them, and are thus the engines for innovation rather than its final product.

George Yu put it this way in response to a question about how his office, George Yu Architects, in Los Angeles, conducts research.

The traditional distinction between research and doing or making is something that's becoming blurred for us. Doing has become research and research has become doing at this point. For us, research is not something that comes before doing – it's maybe even the other way around. Doing is in fact a kind of research. But the bigger question is: Why do research in the first place? I think that the starting point for all our projects is shaped by an attempt to understand and accept the givens of the project in a really optimistic way. To understand the real parameters of the problem at hand and add something unexpected, something that the client may not have been expecting. This kind of research is an absolute necessity given that many of our recent clients were looking for someone to help them develop an organizational vision for the company.

Other forms of interactive prototyping, especially those associated with 3D modelling, have transformed the way buildings are designed and built. Commenting on the use of such modelling in the design and fabrication of the Greenwich Street Project in Lower Manhattan, completed this year, Winka Dubbeldam, principal of Archi-Tectonics in New York, noted the following about the building's folded façade.

The folds in the façade are diagonal, which means the whole space folds inside out and is pulled unlike if it were a simple fold. But this can only be controlled with the kind of precision 3D computer modelling makes possible. During the design phase the slightest change in the fold – whether for code or aesthetic reasons – affected the entire building because it was all one performative system. This also meant that with fabrication everything was controlled by mathematics, by an abstract system rather than by traditional site measurements. This leads to a completely different way of building. When the pieces arrived, they all fit together like a glove. When you see this you realize there is something very beautiful about working from abstract rules. If everyone works by them, and if all the material tolerances are observed, then making the building is all about agreements, codes, notations, not about construction in the conventional sense.

Prototypes create 'design intelligence' by generating plausible solutions that become part of an office's overall design intelligence. Rapid prototyping and the use of scenarios, for example, enables mass production of uniqueness in which the 'final' product is both the design and the array of specialized techniques invented and deployed. Commenting on the kind of design intelligence generated through the use of scenarios and rapid prototyping, Oliver Lang, of LWPAC in Vancouver, observed the following about an extremely fast-pace project then underway in China.

The scenario exercises utilized in earlier projects have become extremely important in helping us test the building and its ability to adapt. We got the job, in fact, because of our approach to phasing and time-based design with scenarios… Platform design and rapid prototyping have been invaluable in developing this aspect of the project. All the research and intelligence generation that we have been developing over the last several years is now paying off and indeed has made it possible for a small, Vancouver based office like ours to take on such immense and complex projects as these in China.

Similarly, offices like Rotterdam-based Max.1 and Crimson focus on the development of what they call 'orgware', the organizational design intelligence that negotiates between the software of policy directives, zoning and legal codes, and building or infrastructural hardware. In the mid-1990s Max.1 was offered a commission to develop a master plan for Leidsche Rijn, a new town extension for the city of Utrecht. One of the first large-scale urban planning projects in the Netherlands that reflected a turn away from subsidized to market-rate housing, Leidsche Rijn required an innovative urban planning approach flexible enough to accommodate the dramatic social and economic changes then occurring in the Netherlands, but strong enough to create a new town with its own unique urban character. Working with Crimson, a research and planning office also from Rotterdam, Max.1 developed a master plan guided by what Crimson called 'orgware', the organizational intelligence used to transform the 'software' of public and private policy directives into the 'hardware' of buildings and infrastructure. Rather than focusing their efforts on an over-designed, inflexible master plan, Max.1 instead designed a plan of negotiation that required certain things to be built while allowing, through built-in redundancies, for other elements in the plan to be sacrificed. This same approach of engendering flexibility through enforced inflexibility, guided Max.1's innovative 'Logica' plan for Hoogvliet, a suburb of Rotterdam, also developed in conjunction with Crimson. Logica, an exemplary form of design intelligence, requires stakeholders to make definitive choices about how the city will develop. The choices were designed by Max.1 after a period of rigorous analysis and were issued as a challenge to politicians and stakeholders to take immediate action. Once made, these choices become the planning infrastructure that allows other, more flexible choices at different scales to be made over time as the city is rebuilt. As Rients Dijkstra, principal of Max.1 remarked at the conclusion of the process.

Logica has now been accepted by the city as the official planning document. All of the choices were made by the council and now cannot be changed. They are the equivalent to the large-scale projects at Leidsche Rijn. That is, they are inflexible, not negotiable. The negotiable part comes in how the choices are implemented by the city of Hoogvliet. The choices are yes-no, and once made, they are inflexible. They are what allow things to actually get done. They are the first, necessary step that must be taken. Now the work of filling in those choices begins.

Part of a one-year series of interviews published in *a+u* in 2003 on 'design intelligence', these four examples of intelligence-based practices cannot be categorized under any existing classification system. Some design boxes, some blobs, some everything from milled panels and coffee sets to urban parks, while others script complex ballets of urban movement. Holding to no philosophical or professional truth, making use of no specialized theory, these practices are open to the influence of 'chatter' and are by disposition willing to learn. Accustomed in ways that their vanguard predecessors can never be to open-source intelligence gathered from the little truths published on the web, found in popular culture, and gleaned from other professions and design disciplines, these practices are adaptable to almost any circumstance almost anywhere.

Though we live in uncertain times, one thing is certain: experimental architecture practices are no longer driven by grand ideas or theories realized in visionary form. Instead, the most influential architecture practices are today compelled by the need to innovate, to create solutions to problems the larger implications of which have not yet been formulated. This, I argue, can only be accomplished with intelligence. Otherwise, design is simply a matter of completing a problem given without adding anything new. Architecture should be more ambitious than to settle for that. Each of the offices mentioned above (and there are many more) have not settled on practices focused on what Drucker calls problem solving; they have instead developed unique design intelligences that enable them to innovate by adding something not given in the formulation of whatever problem they have been asked to solve. They are but the first wave of a remarkable change in architecture practice, and I for one intend to keep track of them even if others are content to continue debating style, form, shape, politics and fashion.

MATERIAL AS A FORM OF THINKING

OLV KLIJN, JANUARY 2005

According to the modernist dictum that form follows function, architecture consists of form and programme. Moreover, architecture exists in two guises: as reality and as idea. Down the ages various disciplines have been deployed as intermediaries between these two guises. Philosophy, sociology and economics were successively presented as important sources of inspiration for architecture. More often than not, the design process itself remained linear and hierarchical, and thus more or less unchanged. Design proceeded in a top-down manner, from big to small, based on an overall idea or concept.

A change would seem to be occurring as we enter the 21st century. Michael Speaks argues that today's information society is shifting emphasis from the philosophical 'knowing' to the practical 'doing'. He discerns the emergence of a 'post-vanguard' architecture practice that differs remarkably from what preceded it. Speaks describes the difference thus: "While vanguard practices are reliant on ideas, theories and concepts given in advance, post-vanguard practices are more entrepreneurial in seeking opportunities for innovation that cannot be predicted by any idea, theory or concept."[1] Architecture here is no longer considered a visionary idea but a plausible solution to unpredictable problems. The intelligent 'thinking-through-doing' would seem an interesting strategy for architects, but what new insights will this approach produce?

A consortium of European cement and concrete manufacturers and architect Siebe Bakker (bureaubakker) took the initiative to answer this question empirically. They looked to curator Michael Speaks, who in turn referred to Michael Schrage to describe the changes. Following Schrage, Speaks argues that: "Design becomes a living, continuous process of creating and testing and as a result more ROBUST."[2] To test this theory in practice, the consortium asked bureaubakker to develop a test case: the Concrete Design Master Class, which also formed the closing event of the International Concrete Design Competition initiated by the consortium. During the competition the emphasis was on the potential of concrete as a material. Under the title *Robustness*, participants studied specific

1 Speaks, Michael, *Design Intelligence*, A+U, # 12, 2002.

2 Schrage, Michael, Professor at MIT Media Lab, as cited in the Concrete Design Master Class Description, Rotterdam, September 2004.

robust properties and applications of concrete. The competition winners were then invited to take part in a master class at the Berlage Institute in Rotterdam. Once again under the title Robustness, and again using concrete, participants spent a week experimenting with non-linear design strategies. The results – the answers if you like – of these experiments are gathered in this publication.
To explore what these first results might mean, I spoke to participants and interested outsiders during and after the master class. I implicitly asked all of them whether they could detect new conditions and any resulting change in design mentality. Another question I raised was whether they detected a changed relation between material and research.

Still thinking in traditional categories, I spontaneously grouped my interlocutors in advance. Theory: Bernard Cache. Concept: Wim van den Bergh. Education: Alejandro Zaera-Polo and Karl Daubmann. Technology: Hanif Kara. Practice: Gigon/Guyer. Each of the speakers did indeed emphasize different issues. But more striking than the differences was the similar tone I detected in all their stories. Each of them spoke of changed conditions. The relation between doing and thinking is apparently shifting towards doing; linearity is disappearing from the design process; and material is increasingly becoming a way of thinking.
For practical reasons it was not possible to speak to these individuals in a prearranged order. I had to deal with situations that arose, leaving aside preferences and planning. Only when processing the results did I finally have a chance to arrange them in a logical sequence, but I chose not to do so. By publishing the conversations in the order in which they took place, it became very clear how people not only see architecture as the sum of form and programme, but also as a way of thinking through material. The conversations suggest that a number of important concepts have been added to the twin terms of form and function. Without any form of hierarchy, these terms are sometimes the cause and sometimes the conclusion of new design strategies. In our case the sequence is: joint and edge condition, invariance and variation, thinking and doing, knowledge and reality, preciseness and flexibility. But it could just as easily have been another sequence. Each of the following interviews is preceded by a short paragraph that introduces the speaker in question. I then let them tell their story in a personal and open manner without interruption.

A JOINT PRACTICE
INTERVIEW WITH **KARL DAUBMANN** BY OLV KLIJN

'A young architect came to ask a question: I dream of spaces full of wonders. Spaces that rise and envelop flowingly without beginning, without end, of a jointless material white and gold. When I place the first line on paper to capture the dream, the dream becomes less.'[1]
With this quote Louis Kahn described the gap between dream and reality that architects have to bridge. On one hand this gap can never be bridged, for dreams are transcendental and will therefore always change when they become reality. On the other hand this impossibility is probably one of the most compelling reasons why architects keep trying.
With the introduction of the computer into the field of design, the architect seems to have acquired a powerful new tool to continue his struggle. The only problem is that the computer is a very abstract tool and building is a very concrete act. The question, thus, is how to link the two in a productive way? Until recently, most architects used computers as mechanized drawing boards. The AutoCAD interface even resembles a drawing board. Though this mechanization, however, most architects seem to have lost contact with reality, with a sense of materials, and with a desire to experiment. Instead of closing the gap, the computer has for many architects widened the gap between designing and making, between thinking and doing. Karl Daubmann – partner at PLY Architecture and professor at the University of Michigan – is trying to create a situation in which building materials and production techniques again become central to the work of architects. Daubmann focuses on both tangible materiality and thoughtful intention to fuel both his teaching and his architecture. In the summer of 2004, at the start of the Concrete Design Master Class, I had a conversation with him at the Berlage Institute. He told of his experiences and strategies and explained that much of this thinking and acting comes together in his understanding of the joint in architecture.

TEACHING AND PRACTISING
Talking about architecture, using computer technology in architecture, teaching architecture and making architecture are, to me, all bound up together. Thinking about materials and the connection between materials and the computer as a design aid

1 Louis Kahn, '*Form and Design*', 1961. Uit: Louis Kahn; Writings, Lectures, Interviews, Rizzoli, New York, 1991

started when I was in grad school. One summer I did an internship with the 'smart materials group' at Ove Arup in London. There I investigated the application of very innovative materials that could change their physical properties. Back in school, one of the things I tried to do was to visualize material properties using the computer. In a way, what I was trying to do was to connect the abstractness of the computer to tangible matter.
When I later started teaching I focused more on simulations. Simulating light and simulating heat using the computer. Of course these simulations didn't deal with materials directly but they did have formal and material implications. I have always considered the University of Michigan an interesting place to do this kind of work because the College of Architecture there has a long history of thinking about buildings and construction materials. Moreover, it has a tradition in applied research in the area of building materials. In 2001, together with some colleagues, I started to build up a complement to the existing facilities: a digital fabrication lab. Up to that point, computers were used for modelling, simulating, and rendering. The Fab Lab ties together the abstract thinking that students were doing on the computer to the messiness and energy of the woodwork studio. Students were trying to build things in the computer very quickly and then make them in reality. From that point on, designing with the computer was not just a mere visual test but also a test of how 'strong' ideas were. Students also tested how they could tie things together. It was very instructive for them to see that things don't fit together automatically. It often looks very easy to connect things on the computer screen, but in practice connections often cause the biggest problems.
In the practice I run together with my partner Craig Borum, our work is also focusing more and more on materials. In a few cases we acted as the contractors and the architect which gave us the opportunity to test our ideas throughout the process. Thanks to this development our work now not only goes back and forth between drawing, modelling and thinking, but it also includes fabricating our thoughts. In realizing our ideas we deploy standard methods, but we also use advanced techniques like CNC Milling and Water Jet Cutting. In this sense our link to the University is important because it enables us to experiment with equipment beyond the constraints of a project. When working on a project that requires use of these techniques, we are able to talk with manufacturers in an informed manner because we understand the limitations of the tools.

RESEARCH

One of our areas of study is that of affordable complex moulds for concrete. Three things converged here. Firstly, I had been using the Fab Lab to build complex moulds for casting. Secondly, I had a research assistant who was building high-end concrete countertops before returning to architecture school to take his Masters degree. Thirdly, Michael Speaks and I had some interesting conversations about the possibilities of concrete while he was teaching at Michigan. These three things came together in our study of new ways to make moulds that were less predictable than moulds produced by milling large blocks of material using CNC Techniques.[2] We started making moulds out of flexible materials such as metal and plastic, and even fabric. The amount of concrete put into these

2 The moulds produced using CNC-techniques are very predictable in the sense that what you see on the screen is really what you will get, together with a lot of waste material.

moulds would determine the degree of 'swelling' and thus the shape of the mould. With CNC Techniques you can theoretically produce countless different building components. The reality, however, is that if you make unique components you use a lot of material. And it takes a long time, because the machines have to be re-programmed for each component. What we tried to develop in our research was an 'edge condition' whereby the mould was always the same but the components produced were all different. Thanks to this method, pieces could fit together in such a way that their edges matched, but a surface condition would interact uniquely with the mould. The interesting thing was that by combining the material aspects of two-dimensional materials, such as metal or plastic, we were able to create complex three-dimensional shapes. What's more, we didn't produce a pile of sawdust as happens with conventional surface-milling CNC Techniques. The thinking that underpins this research underpins all our work where the process of making is linked to the product. Whether we are looking at a steel structure or at house plans, we are always searching for an economic solution with a twist. This means that we are always looking for a space where nothing is custom-made or standardized.

THE JOINT: AN EDGE CONDITION

One of the things I particularly want to teach the students about is the issue of scale. I am trying to teach my students how to scale things up, because normally their work never seems to get bigger than the size of the equipment at their disposal at the university (4 x 8 feet). I teach students that everything we make for a building will have seams, since there is just no way to make large seamless pieces. Instead of describing the seam as an unavoidable necessity, I try to make students use the seams to understand how buildings are put together. I also try to let them make 'connections' across seams – with the concrete pieces, for example, where local surface conditions determine a larger overall pattern.

In our work as architects the limitations resulting from how pieces are produced really influences the quality of the work. I think we have developed an intuition about the limitations that inform the way we think about edge conditions and their potential. The design project that most explicitly demonstrates our ideas about the joint, in other words the edge condition, and about putting things together, is the Big Ten Burrito Restaurant. It is a very small restaurant where we tried not only to express the joint but also to 'break' it. We worked almost exclusively with flat sheets in a very small space. We created the suggestion of depth by introducing a pattern that breaks the seams, and at the same time we defined the space. By using different widths and depths for the groves, we were able to integrate the lighting and the relationship with the outside world into the project. The takeout counter we designed for the restaurant was originally to be made of smooth and shiny concrete tiles. But as the restaurant wanted to open very quickly, we didn't have enough time to produce the tiles. To eliminate the casting and curing process, we used the same files to make tiles in plywood. By changing material we could suddenly make a seamless piece, since it was small enough to be made from a single sheet of plywood. In the end, we choose to make plywood tiles and to express the joints as we had intended. Switching to plywood raised different possibilities, such as revealing the layers in the material. The seams of the tiles now express on a small scale, better than concrete could ever have done, our belief that buildings can be both expressive and tectonic, that they are additive rather than seamless. Thus, in a Judo kind of way, we think that expressing the properties of materials or manufacturing techniques should actually be grasped as an opportunity in detailing buildings. If you take this notion to an even more abstract level, you could argue that architects create the edges along which much bigger issues such as culture, politics and economics take shape.

I hope and think that by making concrete links between computer techniques and design practice, the architectural discipline can become more receptive towards other disciplines. Our understanding of limitations and of edge conditions is certainly a step towards developing different ways in which buildings are thought of and put together. The usual chain of command no longer exists in architecture. No longer does the architect provide the drawings, or files, and hope that his building will be the fulfilment of his dreams. In our projects the discussion about how things should be made continues throughout the entire design process. In a kind of just-in-time manner we collaborate with manufacturers. We build as we design and design as we build. The entire team can ideally keep thinking about the design throughout the process, up to the last minute. The single most important aspect is that all parties learn to incorporate a level of robustness into their thinking and making. This is one thing we hope to achieve with the students in the Robustness Master Class.

INVARIANCE BY VARIATION

INTERVIEW WITH **BERNARD CACHE** (OBJECTILE), BY OLV KLIJN

Ever since Vitruvius, the discipline of architecture has been strongly connected to the idea of a unified body, an ensemble. Alberti's well-known axiom that 'Beauty is the consonance of the parts such that nothing can be added or taken away' explicitly expresses the idea of unity.[1] In classical architecture, precise rules of axis and symmetry underpin the organization of a composition.
Only in the late 20th century have architects started to question the validity of this holistic thinking. In fact, they started the decomposition of the body. A highly philosophical deconstruction of the body was initiated in the 1980s by architects like Peter Eisenman, Bernard Tschumi and Daniel Libeskind. By superimposing information and introducing conflicting grids, these architects created a new complex architecture that could not be described as a single body. During the 1990s this idea of a multifaceted architecture developed into theories of multiplicative organizations. Complexity in architecture developed into a notion of composite that was neither multiple nor single. An important role in this development was played by the computer, a new tool that had just entered the world of design. Due to the computer's paradoxical capacity to be at once instrumental and spatial, its introduction into the field of architecture fuelled the questioning of the inherited nature of space. Architects started to explore ambiguous morphologies, and design processes became more dynamic and fluid, more life-like as some people argued.[2] In these first years of computer designs the built results often disappointed. There seemed to be a wide gap between what architects dreamed on the computers and what builders could produce.
Only in the last few years have attempts been made to link architecture software with manufacturing. A leading architect in this field is Bernard Cache. He has been involved in developing software that enables architects to think further. The software that he worked on allows architects to develop a personal design logic while ensuring that all parts of a design remain consistent. The work of Objectile – the office Cache founded in 1996 with Patrick Beaucé and Jean-Louis Jammot – shows there doesn't have to be a gap between design and final product. Cache has recently been teaching at the Berlage Institute in Rotterdam, which is where I met up with him. He spoke of his personal journey into software development, how his software brings classical geometry back to architecture, and how he want to create freedom for architects.

STARTING FROM DUST

As a student at the Polytechnic School of Lausanne I followed a class about large-scale architecture, focusing in particular on the relation of buildings to the landscape. We had to make big models to represent the landscape. As anyone who has ever made such a model knows, one of the key things is the free shape of the landscape. At that time there were no computer applications that could help us, so we had to make the models by hand. I learned all the manual processes and swallowed a lot of dust as I sanded free surfaces. After swallowing so much dust, I needed no motivation to find ways to save my lungs. That's when I started to investigate what was happening in the field of computers. At that time it was very difficult to work with free surfaces in a CAD/CAM programme like AutoCAD. To work with these surfaces on a computer, you had to use sophisticated software such as UCLID or CATIA. This software didn't run on normal computers, only on big stations that don't have an operating system like Microsoft. If you wanted to work with these machines you really had to learn their 'language'. Since France is one of the countries where people have been very successful in making CAD/CAM software, I was fortunate to get in touch with some of the writers of CATIA software. Through them I was able to get a good basic understanding of the possibilities at that time, and I explored the future implications for architects. The first important step in developing software for architects was the transfer of existing software from mainframe stations to more conventional computers. By the time this step was taken I was no longer a student. I worked for a company called Missler, the same company I am now developing the TopSolid software with.

INTUITIVE GEOMETRY

At the beginning of my journey into computer software, an important problem was of course to believe that this technology really would provide what I wanted. But as I worked more with the computer my confidence grew and I started to understand how important the free surface is for architecture. Under the guidance of Gilles Deleuze I developed this notion into a thesis on 'inflection'. Later this thesis formed the starting point for my book *Earth Moves*, which was published in 1995 and which Deleuze refers to in is famous book on Leibniz: *The Fold*.
The notion of geometry that I describe in *Earth Moves* differs considerably from the ordinary – euclidean -notion of geometry. The ordinary understanding of geometry as we've known it ever since the Baroque era is based on the work of Descartes, Leibniz and Newton.[3] About the same time that Descartes was writing his discourse on method, France mathematician and architect Girard Desargues wrote a book called *Rough draft for an essay on the results of taking plane sections of a cone* in which he describes projective geometry.[4] This was a new type of geometry that considered all conical forms – i.e. all the curves that one can obtain by intersecting a plane with a cone – to be single curves that have the same properties. Although Leibniz had heard of Desargues, for some reason he didn't follow down on his track. If he had our

1 Here the Alberti quote is taken from Stan Allens' beautiful text on hierarchy, *Field Conditions*, in *Points and Lines: Diagrams and Projects for the City*, Princeton Architectural Press, 1999

2 One of the architects who rose to prominence during this period is Greg Lynn. In numerous projects and publications he links his ideas about computer technology and architecture to ideas about evolution and life itself. See for instance Lynn's Embryologic Houses© project from 2000.

3 Euclidean geometry describes our three-dimensional world in terms of the Cartesian grid (X,Y,Z). This description of reality fails if one wants to describe the imaging process of a camera: lengths and angles are no longer preserved, and parallel lines may intersect. Euclidean geometry is actually a subset of what is known as projective geometry. Projective geometry doesn't take the Cartesian grid as its basis but projects points from the centre of a sphere. Projective geometry therefore allows a much larger class of transformations than just translations and rotations. It also includes perspective projections.

4 Original title of his book was *Brouillon project d'une atteinte aux evenemens des rencontres du Cone avec un Plan*. A small number of copies was printed in Paris in 1639. Only one is now known to exist. The book is short, but very dense. Desargues gives a rigorous treatment of cases involving 'infinite' distances, and then moves on to conics, showing that they can be discussed in terms of properties that are invariant under projection.

common understanding of geometry probably would have been different because, if you read the Desargues text carefully, all the notions of folds and bifurcations are there. Now why is this important in relation to computers? At the beginning I was interested in curved surfaces, and as mentioned before at the time these surfaces could only be drawn by hand or calculated on computers using complex formulas. You couldn't really 'draw' these surfaces on the computer, never mind change them quickly. Now if you want to control concavities and convexities on a three-dimensional surface during a production process, the best way is to calculate all the elements and produce them with computerized machines. Searching in the tracks of Leibniz – i.e. using analytical geometry – I discovered that it was impossible to develop the software that would enable architects to do this. It was not until Parameter Technologies, an American company, developed a new type of associative CAD/CAM software that we were able to turn the work of Desargues into useful software.[5]

The associative CAD/CAM software I produced with Missler is called TopSolid. It is a type of software in which you have a few 'parents' of your files. These parents can be either numbers or points. On top of the parents you build your design that can be easily modified, while the parental constraints remain intact until the translation is converted into a 'machine file'. The way in which TopSolid works with geometry is not by using the Leibniz notion but by using the projective geometry of Desargues that I described. This software thus brings classical geometry back to the computer. What is classical about this geometry is not that it is 'old', but that it is a geometry with which you interact by drawing points and lines. It signals a return to intuition in geometry. For me, the fact that architecture deals with the physical and architects interact with reality through graphical figures was the most important change brought about by this software. Now you can manipulate a spatial concept on a computer, not by writing formulas but by drawing graphical figures.

TOPSOLID

After a number of years working on the TopSolid software from this perspective, we were able to incorporate another aspect that is very important for architects: the notion of a variable component. Imagine yourself drawing a complex façade made up of uniquely shaped panels in which nothing is orthogonal. Adjusting the panels in this façade is very time-consuming and is not much different from swallowing dust like I have described earlier. Using TopSolid, however, you only have to correctly identify the parents of your panels and you can easily make adjustments without distorting the logic of the design. What this means is that as long as you define the relations between different parts of a design, changes to the design will not affect the defined relations. Finally, this software means that architects don't have to rely on given systems, such as digital libraries with standard components, but can create there own internal logic, their own style if you like.

Apart from saving a lot of time, a big advantage of this type of software is that the designer doesn't have to think of a building as an isolated object but as a series of objects that vary. For me, this changes many things in architecture, because the idea is no longer

5 The most common solution for proceeding from CAD to CAM has been to import CAD files into a CAM system. When utilizing CAD and CAM products that are not integrated, information exchange between the two is extremely limited. Information from CAD must be verified and often corrected manually, and can be lost completely.
In a good associative CAD/CAM system, you can import a component created in another system and make it part of a native assembly to ensure that the imported part is manufacturable.

to create a unique object with wonderful properties, but to set up rules in space that allow for certain variations. This, in fact, is what all sciences are about: invariance by variation. I think this is also basically what architecture should be about. Since space is something that is very difficult for people to cope with, architects have to devise rules. At the same time, people need change and freedom, so architects should incorporate this. They should provide both rules *and* freedom.

THE FUTURE OF ARCHITECTURE

Now that we have the computer tools to supply both spatial rules and freedom, it doesn't mean that life for architects suddenly becomes easy. One of the most important aspects of digital technologies that is often pushed aside is the fact that these technologies usually don't match the general organization of the production system in contemporary society. The assumption is that once the computer techniques are there, architects can use hem. A good example of how this mechanism works is the Guggenheim Museum in Bilbao. The general public regards this building as clear evidence that architects in the late 20th century are no longer restricted to making orthogonal boxes. They think that architects these days can build whatever shapes they imagine, at no extra expense. Personally, I have nothing against the Bilbao, but in terms of computer and production technology it is a monster! First of all, the software used to make the building is incredibly expensive. Only star architects like Frank Gehry can afford it. Secondly, the design itself is very uneconomical. At some points there is a distance of seven metres between outer façade and internal wall. Thirdly, Frank Gehry does not draw his buildings on the computer. Like a sculptor, he makes hand-made models that are then translated into computer models. Although I think it's fine that if you have so much money you can ask Gehry to make a spectacular building, his work does not reflect what is going on in architecture. In fact, Gehry's architecture is the expression of a 'star' economy. By definition, this star economy is only accessible to a very limited number of people and is thus an unrealistic example. What Bilbao illustrates is not what is possible with computers in architecture but simply the deregulation of society: the disappearance of the middle class in America and Europe.

Speaking for my own architectural practice, we discovered that we not only had to develop our own software but also build up our own production facilities because no company would allow a group of enthusiastic architects to do experiments on their expensive machines. Having had this experience and knowing that our work can only influence architecture if normal architects can use it and develop it, I try to ensure that our work is not exclusive. My aim is not to create spectacular amorphous objects like Bilbao. TopSolid software can run on a normal computer and is intended for ordinary architects and students. The changes that this software can facilitate are important, though perhaps not spectacular. Honestly, it isn't hard to predict that within a hundred years the structures for most buildings will still be orthogonal. Distorted structures like the Bilbao building are not the future of architecture. The real freedom will be in the cladding, I think – cladding in the broadest sense of the word.

THINKING BY DOING

INTERVIEW WITH **WIM VAN DEN BERGH,** BY OLV KLIJN

'I think, therefore I am.' With these words French philosopher René Descartes formulated an important principle of Western science. A direct consequence of his thesis, he reasoned, was that the brain had to be considered independently of the body that houses it. Partly as a result of this conclusion, science was marked by impersonal and incorporeal patterns of thinking until late in the twentieth century.
Although architecture can be considered a scientific discipline only in a limited sense, it too has developed a detached cause-and-effect mode of thinking. A key aspect of this mode of thinking is the desire for certainty and truth, and the elimination of chaos. Matters such as function, composition, materiality, and organization are viewed as problems to be solved individually.
But alongside this general view, there are views held by some architects that do not proceed from a determinist perspective. In such cases, the completeness and the complexity of spatial experience forms the starting point for architecture. Following on from another French philosopher – Maurice Merleau-Ponty – these architects maintain that architecture is always a bodily experience. Or as Merleau-Ponty put it: 'We have access to the things and to the world through the intermediary of the body.'[1]
Someone who occupies an interesting position between both camps as a result of his multi-faceted architectural education, knowledge and experience is Wim van den Bergh, professor of *Wohnbau und Grundlagen des Entwerfens* ('Housing and Fundamentals of Design') in Aachen and architect in Maastricht. His experience in design education in particular is a reason to talk to him about the changing relation between thinking and doing, between freedom and limitation, between creativity and innovation in architecture. We met in an architectural 'non-place': a motorway hotel. I started the conversation by asking him about the value of a design competition, that ultimate cliché when it comes to generating new ideas in architecture. How effective is this method from the point of view of an educator?

1 Maurice Merleau-Ponty, Le visible et l'invisible, 1964, p. 30, here quoted from OASE # 58, 2002, p. 5

THE COMPETITION

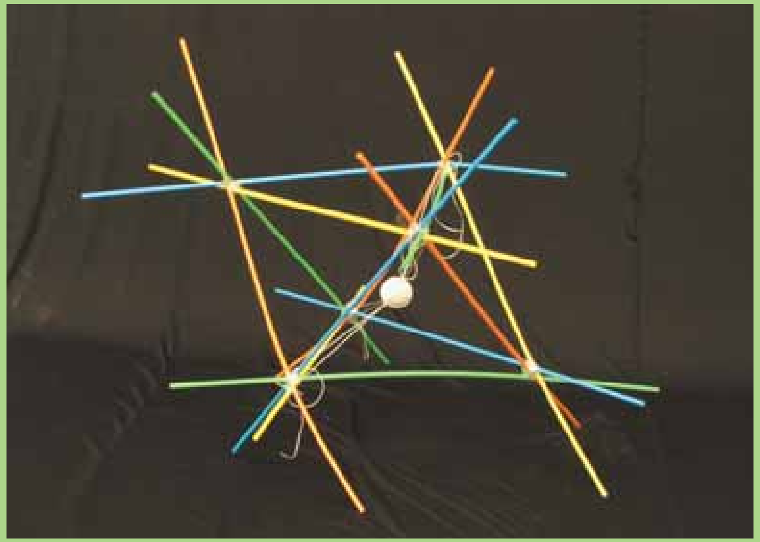
A general rule, I think, is that a competition is only as good as the task it sets for entrants. In other words, it is as good as the actual formulation of the design assignment. The more general the formulation, the 'less' a competition normally produces. After all, an assignment worded in very general terms will only yield general solutions. But the more a competition focuses on a specific subject, and the more it is governed by rules – by limitations – the more creative the entries must be. A precisely drawn-up assignment places a much greater demand on the intelligence and inventiveness of the entrants. So the precise formulation of the challenge determines the effectiveness of a competition in advance.
To me there are always two important aspects to an architecture competition. The first is the location, the second the programme. In the case of both, a carefully formulated assignment and clear rules largely determine the quality of the entries.
From an educational perspective, the competition itself can be an interesting learning tool. Once again, it's the formulation that makes or breaks the effectiveness of the tool. The German education system, in which I have been mostly active in recent years, recognizes the phenomenon of the *Stehgreif entwurf* [2] in which a very specific task is set. A good example is the task given to students by my colleague Mirko Baum. 'Make a design to let three eggs fall from a bridge'. The students were asked to think about the easiest way to pack three eggs so that they could be dropped from a height of around five metres and remain unbroken after hitting the ground. To come up with a solution, students naturally had to think about the absorption of shock and what happens upon impact. These are complex issues, yet the challenge itself was formulated very clearly. Students have to call on all their inventiveness and creativity to come up with a strategy. In short, they have to think about design problems.
Another type of challenge that can be very effective is to design actual objects using just one material. An example: 'Design a crate in which a publisher of architecture books can transport 15 kg of books safely. The crate must also be able to be used to display the books. The only material you can use is cardboard.' The problem is clear, but the restricted use of material means that there is no obvious solution. A response to this challenge therefore demands creativity and inventiveness. Both of these are examples of 'competitions' that will yield concrete results – results in terms of the form, the function, the material, and the method of production.

2 This type of assignment is a focused exercise in which specific design skills are developed.

ARCHITECTURE WITHOUT BUILDINGS

The examples I have cited do not, at first, sound like typical architectural assignments but, rather, as tasks for industrial designers. But I think there is little difference between both disciplines when it comes to design. Partly in response to the trend at German universities to affix *'und entwurf*' ('and design') to almost all chairs, I have attempted to define the term 'design' for myself. My conviction is that design is primarily a question of creation. Three concepts can then be distinguished within creation. The differences between the three concepts are clearest in German. Creation is firstly about *Gestalten* ('to give form to'). Then it is about *Planen* ('to plan'), in which functional aspects and the time factor play an important role. Finally there is *Konstruieren* ('to construct'), the actual making of things. Creation (i.e. design) is in principle always about these three factors combined: thinking, making,

testing. The thought process is more or less the same in all disciplines. Whether you are dealing with architecture, industrial design, or devising a strategy, you are always dealing with a comparable process of thinking and doing. Accordingly, creation is in principle the same for a photographer as it is for a musician.
The distinction that we could make to determine whether a particular process results in architecture depends on how we define architecture. If we define architecture as the making of structures, then it ranges roughly from the scale of the city (made up of many buildings) to a piece of furniture (the smallest object that is still 'built'). The disciplines of urban design, architecture, interior architecture, and furniture design are normally distinguished across this wide spectrum of scales. Although a distinction between disciplines can be useful, it is remarkable just how often the borderline areas between the disciplines are where 'contamination', so to speak, gives rise to interesting new insights. And if we think it through, then the logical consequence is that the automatic connection between architecture and building should be broken. In other words, elementary design assignments like those I have described force students to let go of the assumption that spatial problems must, by definition, be solved with a building. These assignments can lead to interesting new solutions and links with other disciplines.
In fact, much of my teaching is geared to breaking down standard design patterns. An important step in this process of breaking down is often the search for a strong connection with everyday reality. It is easy to hold an abstract and philosophical debate about architecture within a university. But it is often much more difficult for universities to deal with practice. The difficulty is that the problems of practice are often very different in nature than educators assume. Let me give another example by way of explanation, only this time a more extensive one.
There is a lot of emphasis today at the university in Aachen on what's called the third source of income. This refers to funding provided by external agencies or individuals for research conducted at the university. At the Department of Housing we came into contact, through the Department of Modernization of Old Buildings, with the property director of Krupp. This multinational owns real estate all over the world. In the region around Essen (Germany), however, Krupp faced a big problem with its housing stock. In the 1950s and '60s the developer built many semi-detached homes in the region. Families with up to six children once lived in these homes, but by today's standards they are hardly suitable for a family with one child. An added difficulty is that these are rental dwellings occupied by tenants with an average age of around 70. The problem is that many of the homes will be vacated in the coming years as tenants either move to homes for the elderly or pass away. If the dwellings are let to new tenants, Krupp will be stuck with the new tenants for a very long time. To solve the problem of outmoded homes, Krupp considered leaving vacated homes unoccupied so that all homes could eventually be demolished. But the prospect of an increasingly impoverished neighbourhood with more and more boarded-up windows was not very appealing to Krupp nor to Essen. So the question was what to do with these houses?
To answer this question, we conducted market research around



Essen. It turned out that there are relatively many double-income couples who are about to start a family and who would prefer to move from the city-centre apartments where they now live to homes on the edge of the city. In terms of location – close to the centre and surrounded by gardens – the homes owned by Krupp meet the needs of this target group perfectly. In terms of size and spatial layout, however, the homes are not very suitable. We then came up with the following strategy: As soon as one half of a semi-detached pair of homes becomes available, it is sold to a double-income couple. This couple buys the house on condition that it have first option to buy the adjoining property when it comes up for sale. The buyers take something of a risk here, because they cannot predict when the neighbour's house will be available. But the advantage is that they know for certain that their house can eventually double in size. In other words, with relatively little investment and a correspondingly low mortgage, they have the chance in the near future, when income and family size are on the increase, to buy a bigger house without actually moving house at all.
The only thing we as architects did as part of this proposal was to study ways of combining the existing dwellings. We then highlighted the advantages of this new dwelling typology. Particularly when you think of the increasing popularity of teleworking, the possibilities of a house with two front doors are limitless. Finally, we considered the urban-design implications of this strategy. In short, we operated along the edges of the discipline of architecture. And our response to a spatial problem was not to propose a new structure but to transform an existing structure, since this approach offered much more potential.

NEW COMPETITIONS
The same is true at the level of materials, the application of materials, and techniques used to process materials. Here, too, a way of thinking that does not assume the need to make new structures but, rather, to come up with solutions to concrete spatial problems can open up interesting ideas. Take the example of Spanish-Mexican architect Felix Candella who, when there was no timber available to make concrete formwork, devised another processing method. He turned the positive-negative thinking traditionally applied in designing formwork for concrete on its head and poured concrete onto a mountain of sand topped by a mesh of reinforcement. Once the concrete had solidified he dug away the sand to leave a space.
If we keep this example in mind and think again about the competition as a learning aid, then there are definitely possibilities for a competition, like the Robustness Competition, that focuses entirely on one material. Since competitions of this sort are still rather new to architects, a good assignment is not the only thing that matters. It's also important to think about the problem of unfamiliarity. A good way of dealing with this might be to defer staging a student competition and, instead, to ask a number of young architects to work with a particular material. The next thing is to make sure that the results of this preliminary phase receive plenty of media attention so that people become familiar with the project. Only after young architects have set the tone, is it time for students to have go.

As I already said, the wording of the assignment is crucial, just as with any other competition. The smart thing about a competition like Robustness is that the abstract formulation of the assignment makes it easy to integrate into different education systems. Yet that is also a major weakness of this competition. I think that if the assignment was a little more precisely formulated and if, through the involvement of young architects, more tangible results could be achieved in advance, then this form of competition has great potential. Thinking about the possibilities of a sequel to Robustness, I think that the self-build industry might be an interesting option. This sector is growing strongly not only in the Netherlands but also in Germany and Belgium. I think that competitions that focus on materials could focus very specifically on the design of components that consumers themselves can build with. Just as they did back in the 1970s with the popular patio blocks made by pouring concrete into a plastic mould and used to build garden fences. You only have to combine this example with that of the American Case Study houses to realize the architectural potential of the self-built house.[3]
Another interesting way of innovating from within the industry is to invite young designers to take a look behind the scenes. After all, there's a good chance that they'll see things in a production process that are worth thinking about further.
In both examples, breaking down the barriers that divide disciplines is a way of creating space for innovation. In today's safety-conscious society, in which everyone tries to avoid taking risks, space for experimentation is often greatly decreased rather than increased. Innovation is hindered before it has even had a fair chance. The interface between university and practice is one of the few areas where opportunities still exist. With the aid of the prefabrication and self-build industry, this is an area that could be extended in the future.

3 The Case Study Houses were built in the period 1945-66 around Los Angeles as a result of a synthesis between industry, architecture, catalogue homes, and the architecture periodical Arts & Architecture headed by John Entenza. Even today these houses are frequently cited as very successful examples of architectural research.

KNOWLEDGE OF REALITY
INTERVIEW WITH **ALEJANDRO ZAERA-POLO,** BY OLV KLIJN

Alejandro Zaera-Polo is undoubtedly best known for winning, with partner Farshid Moussavi, one of the most important design competitions of the 1990s: the Yokohama International Port Terminal (1994). The finished building differs considerably from the competition entry, of which jury member Rem Koolhaas said: 'The shape of the building itself *is* its structural solution.' Instead of creating a fluid terminal made out of honeycomb sandwich panels, Foreign Office Architects (FOA) – the office Zaera-Polo and Moussavi established in 1993 – created an incredible origami building.[1] The building has already been dubbed the Centre Pompidou of the '90s and published in all international architecture magazines.
Apart from proving that young architects heading relatively small practices can produce important architecture, FOA is also a source of ideas about the role of the architect, and these are worthy of consideration. In a world of increasing division and specialization, FOA tries to give the architect a more pivotal role. It believes that for too long architects have focused on non-architectural problems. It would make a lot of sense, FOA believes, if architects refocused their attention on architecture. As FOA puts it in its recent publication *Phylogenesis*: "By defining an architectural practice, a location, a scale or a program as a lineage of consistent, evolving and non-contingent groups of organisms we are able to establish an effective feedback between bottom-up and top-down construction processes." Instead of being the visionary artist who pursues dreams, FOA wants to get in touch with reality, with how buildings are made and how materials behave.
This focus on a more applied way of working, as opposed to a purely theoretical approach, makes FOA interesting in relation to the Robustness Concrete Design Competition and master class. The recent appointment of Zaera-Polo as Dean of the Berlage Institute in Rotterdam – host institute for the master class – is a second reason to speak with him in London. He talked about his ideas on education, about how important a close relationship with the outside world is, and about how architecture as a practice or as part of an educational system is one and the same thing to him.

1 For the original competition entry of the Yokohama terminal, structural engineer Cecil Balmond made an innovative design in which the shape of the building would eliminate all columns. This design was abandoned for cost reasons and replaced by one based on folds that created strength.

PERMANENT EDUCATION
My theory is that there isn't, or at least shouldn't be, much difference between working as an architect and working as a teacher. In fact, the FOA office emerged out of teaching. We moved to London to teach at the AA before we had any projects here. Over the years we got the opportunity to start an office, but the people we worked with were often former students of ours. We've tried to maintain this system of close relationships, but the pressure of a more professional performance is changing the situation somewhat. Although I am very much in favour of working with young and relatively inexperienced people, clients don't always appreciate this. But so far we haven't had to hire people from outside.
What's important to me about working with inexperienced people is that the office becomes a place of learning, the venue for ongoing education rather than one where professionals simply perform tasks. The key idea is that we are all learning no matter what stage we are at, whether we are actually making buildings or projects at school.

Ever since I started teaching I've tried to maintain a close relationship with reality. All our projects at the AA, for instance, were realistic projects. Most were even located in London, and students could easily visit the sites and talk to the people involved. So we would never sit down and think what is relevant in architecture today. Instead, we would go out and see what projects were 'happening' and we would try to bring these into school. Our approach was unusual at the time. I wouldn't say we were the only ones, but we were one of the few who really stressed the fact that knowledge of reality is very important.
As Dean of the Berlage Institute I'm trying to establish a relationship between reality and practice. The way I do this is by employing what I call a 'double agenda'. This means that I constantly keep an eye on what's happening in reality. I'm convinced that the Liberal Arts model, on which schools like the AA in London or Columbia in New York are based, has run its course. These schools produce visionary artists instead of architects who can deal with today's hectic reality. I'm interested in an approach geared to production rather than criticism.
As I have said before about FOA, this relation with reality creates a state of continual education. What is scary, however, is that clients, especially in the UK, expect us to have 45-year-old project managers because they think they are better. I, for one, think they are completely wrong and frustrate the learning process in the office. But they are the clients.

CONTACT WITH REALITY
I don't believe that doing and thinking can be separated. You think because you have to solve a concrete problem. I don't think that you can contemplate on what is relevant today without 'looking outside'. You have to be constantly in touch with the world around you and apply your thinking to real problems, not ones defined by your imagination. I'm very critical about many of the didactic approaches of the 1980s in which architects developed an internal debate and critics were busy telling us how a certain piece of architecture responded to the discourse of Derrida or Deleuze. I'm not saying that these discussion weren't interesting, but I don't think they dealt with the source of architectural thinking: they don't deal with space, shape, materials or production technology.
In the 1980s a number of experiments opened up the discipline.

Architecture engaged with cinema, literature, cultural theory, sociology and economics. I was educated during this period in America where I learned to discuss issues like gender and disruption. Architecture was something of a spin-off from these discussions. Before going to America I was exposed to almost the opposite situation in Spain – high demands in terms of technology, low in terms of theory. I enjoyed both approaches, but neither of them is sufficient on its own.

We see now that people realize that architects cannot continue to seek legitimization for their work by discussing cultural theory. Moreover, architects are realizing that they finally have to make buildings and to do that they have to learn about technology and materials. Thanks to this change of climate there is a generation of architects emerging which is much more interested in exploring this side of the profession.

I'm from the first generation of architects able to use the computer as a tool. Simply because of the fact that software had developed far enough, I could use computer technology to design. Before my time this wasn't possible, and later generations are of course much better than I am. They have really grown up with computers. I grew up with conventional media and had to make a switch. It turned out that I switched at precisely the right moment. I started with AutoCAD, version 10, and I was working on a 386 computer – ridiculously simple compared to today's technology. Thinking back, I was doing nothing but drawing in a mechanical way. Now the possibilities for using the computer in design have expanded enormously. You can perform complex geometrical operations with ease. You can incorporate time and simulate processes. This obviously broadens the range of possibilities hugely, but at a risk. Although it can be exciting to see students using certain software straight away and producing amazing things, they often don't understand the basics of their operations. This lack of basic understanding means that students don't acquire sufficient mental rigor. The problem today is that you can build everything in the computer, but if you want to construct these things in reality the gap you have to bridge is very complicated. In general, I think that projects become much more interesting if they take the geometrical qualities of materials into account. If architects don't try to feed material constraints into software, they become moviemakers or image manipulators instead of designers who actually construct things.

HOSTING ROBUSTNESS

Hosting a master class on the theme of Robustness at the Berlage Institute is interesting because it addresses the qualities of materials. In a way, it all has to do with what we discussed about the 1980s. In that period it was almost as if architects had given up completely on the potential of practice based on investigating materials. Everybody thought that an architect was a good journalist, or some exotic figure who could make nice photographs and discover new ways of living. Of course this did happen, but it was only one side of the story. While architects focused on the social side of things, enormous developments were taking place in the fields of construction technology, material science, and building management. But since architects weren't 'looking' at these developments, other professions stepped in and made them their own. As a result, a typical project now involves a whole range of managers, engineers, cost calculators and others, whereas previously the architect took responsibility for much of the work. Architects knew how to put buildings together; they knew the properties of materials.

The generation of architects educated in the Anglo-Saxon system over the last decade has completely forgotten how to think about materials – this is very regrettable! I'm not saying that architects should control everything again – that would be impossible. But architects should have sufficient knowledge of all related disciplines to at least supervise the building process.

In juries at the Berlage I have noticed that students often think that they will have engineers to solve their problems. This is a big mistake that is costing the profession dearly. As supervisor, the architect should speak with specialists early on and not just produce a wonderful spatial concept that is then left to the engineers.

My idea of the Berlage Institute is that it should not be a school. It should be a laboratory for applied research. One of the things I am trying to do as Dean is to incorporate clients systematically. The work we do in school shouldn't be something that ends at the final review. By relating the design studios to people outside the institute, we can be testing and developing in tune with reality. By introducing technology specialists like Bernard Cache to the Institute, we can tap into the kind of knowledge that has been ignored in the architectural discourse for too long. For me, one of the most important experiences was how to make sense as an architect. As a child of the 1980s, I had to learn how to stop talking in theoretical terms and start speaking about real problems.

ANOTHER LEVEL OF PRECISENESS

INTERVIEW WITH **HANIF KARA**, BY OLV KLIJN

Architecture is a material discipline. Its aim is to transform unformed matter into meaningful artefacts. Regardless of intent, architects traditionally give form to matter, but within limits. Or as Jeffery Kipnis has put it: 'No cultural practice is more indebted to a technical apparatus than architecture to geometry. This is for the obvious practical reasons of course, but more importantly because of the Cartesian Imperative, the irrepressible sway that geometric form and organisation hold over our imagination. Each of architecture's major spatial innovations (…) has been enabled by geometry. Indeed, only a fool would speak of architecture after geometry, if by that is meant that for some reason and through some new apparatus architecture could forget geometry, abandon it, leave it behind.'[1] Yet over the past decade a number of buildings have been designed and built that seem to do just that: abandon geometry and challenge gravity. One of the main reasons these buildings were constructed is that leading architects have found a new companion in the structural engineer. Of course there have always been engineers who created beautiful structures – just think of Eiffel's Tower – but these pieces were never really considered architecture. In the late twentieth century, however, structural engineer Cecil Balmond is said to have reinvented architecture by breaking down the barrier that separated structural engineering from design.[2] To find out what has suddenly made the structural engineer the architect's best friend, I spoke to one of the leaders of the generation following hot on the heels of Balmond: Hanif Kara. We met at the Adams Kara Taylor office in London and spoke about the engineering firm he set up and about his own background. Kara explained how important it is for engineers to be able to think and make at the same time. We also discussed Kara's involvement in the Robustness Design Competition and how this initiative should continue.

1 Jeffery Kipnis, *Informe: strategies of the formless*, edited by Marc M. Angélil, Mark Lee and Cary Siress, p 23, ETH Zürich .

2 This sentence is taken from the opening of an article by Jennifer Kabat, *The Informalist*, in Wired magazine April 2001.

FILLING THE GAPS

Up until twenty-five years ago there was a tendency for design engineers in Britain to leave big companies like Ove Arup and start up on their own. This stopped during the 1990s because many of the big successful offices wanted to grow even bigger. They didn't want to design just buildings anymore; they wanted to design countries.

From the moment our practice started in 1995, our aim has been to go back to pure structural engineering and make interesting buildings. And although we are happy to work with renowned architects like Sir Norman Foster and Zaha Hadid, we particularly want to work with younger architects. MVRDV in Holland and Foreign Office Architects in England are among the leading offices of the generation we like to work with.
The three partners at Adams Kara Taylor met while working for Anthony Hunt.[3] We started to work together but we all had very different backgrounds. Mine was in welding. I started as a welder in a steelyard. In those days when you wanted to make something you would draw it full scale on the floor. And if pieces were complicated you would make a template, a full-size prototype in timber. Buildings were made in much the same way as ships are made. I took my degree at Manchester University through a combination of work and study. Looking back, I feel our current practice has gained a lot from this type of education. Although I had a very old-fashioned schooling, I did learn to do two things together: to practice and think. So early in life I learned that every time somebody from one end of the practice spoke to me, I had to think of the other side.
So if, for instance, a manufacturer now is talking to me, I'm always thinking how I can involve a student; and when a student is talking to me I'm always wondering how I can make him work out how things are put together. After graduating, I worked for two years on off-shore structures in Aberdeen. Towards the end of my training there I became interested in fairgrounds, especially roller-coasters. What interested me about these structures was the almost empirical way in which they were built. Long ago, craftsmen built roller-coasters out of timber. Yet they have a very complex stress pattern and behaviour pattern, not to mention a complex lifecycle. In the office I worked for back then, we started a small group specializing in fairground structures, and we started doing inspections. My interest in the subject was fired by the combination of design knowledge and craftsman's intuition. It then occurred to me that as a structural engineer you need extremes of both. Ever since, my aim has been to create a situation in which you can analyze, simulate and design at an extremely high level. This means that you must always be aware of the most advanced technical possibilities, and at the same time you have to be able to talk to the people who know how to make things.
In theory, everybody involved in the building process is supposed to talk to one another, but in reality there are lots of gaps in the process because most people are only able to think about one aspect of the discipline. By the time information gets to me, the structural engineer, it is full of gaps. My partners and I felt that our company should fill those gaps by trying to think in a cross-disciplinary manner. This was also an important motivation for me to get involved in architectural education.

3 Robert Adams, Hanif Kara and Albert Taylor. The three partners worked for Hunt, who over the past three decades has been involved in numerous famous projects, including the Wills Faber Dumas HQ by Norman Foster in 1975, Inmos Ltd by Richard Rogers and Partners in 1982, and The Eden Project by Nicholas Grimshaw and Partners in 2001.

TRAINING ARCHITECTS

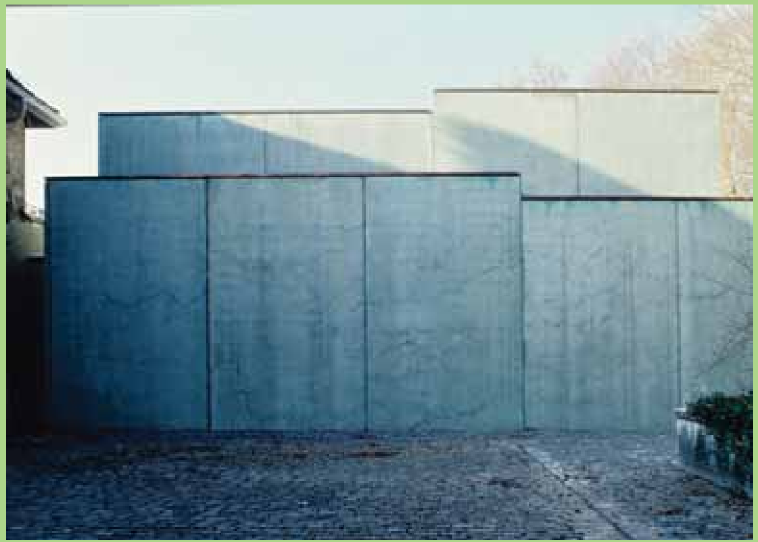
I'm an engineer who believes that the architect is the creator. The engineer is the man who makes things happen for him. I never really felt that we as engineers were in control. Always analyzing and optimizing, we are trained to think in contained boxes and have a very precise answer to everything. The architect, on the other hand,

doesn't have to have a precise answer; he has to dream. The architect is judged on what he produces, whereas the engineer is judged on how he produces things.
I always felt that if I could be involved in training architects they could learn something from me and I could learn from them.
Eight years ago I got the opportunity to teach at the Architectural Association (AA) in London. I started teaching in the Design Research Laboratory. For the last four years I ran a diploma unit with a landscape urbanist. I was very keen to put this unit together because it enabled me to test aspects of the cross-disciplinary agenda I wanted to promote. We brought students into contact with some young engineers at Adams Kara Taylor. So all students had access to the office, and the office had access to them too. What happened was that while students were 'dreaming' they were subjected to a number of reality checks. Wherever possible, we also brought students into contact with manufacturers. The unit was very successful, and in a way what we did at school is what we do in our office. In everything from standard to extreme commissions, we try to combine the making of things with research.
A good example of an extreme project we are now involved in is the Wolfsburg Science Centre by Zaha Hadid. The structural concept for this project is not the usual post-and-beam structure but something completely new. Here the structure itself has become a research project for us. When we won the design competition with Zaha there wasn't any software with which we could calculate the structure. So from the outset of the project we didn't know how the structure would work, but we were confident that we would succeed. We spent a year perfecting our software, and all the while the project continued on the basis of safe redundant analysis.
The mentality with which we approach a project like this is one of the key elements in the success of our practice. Everyone in our office is a maverick, and they all want to take risks and make something different. At first, many people were sceptical about our approach. They thought we were just crazy engineers. Slowly, however, the outside world is starting to see that we are achieving interesting results. Now people are starting to like us. I feel we are really creating a new culture. To most engineers, our way of working is far too artistic, but for us it is just another level of preciseness. Still very much engineering, just more creative.

SOMETHING COULD FALL ON YOUR HEAD

In the last five years I think there has been a very intense conversation going on in the world of academia. In essence, it's a discussion about who is the brightest, and who can do the most intelligent things. The negative thing about this situation is that knowledge ends up confined to academics.
At the same time, I notice a more positive development. Academics are starting to recognize the importance of being able to think and make at the same time. But at most academic institutions I visit, there are not that many people practising and teaching simultaneously. What's more, the academic world has little influence on my own professional world of construction. It's the people with money who are driving the industry. Clients are therefore the ones setting the agenda, and if they want fewer thinkers then that's what they get. Thanks to computers, I see the beginnings of more mixed disciplinary approaches that could lead to a new understanding of engineering. But there are still difficulties to overcome. If you look at it in the long term, certainly engineers, but probably architects too, will have to develop a cross-disciplinary way of thinking, or else they simply won't survive.
The role for academic institutions is to facilitate this change. And that's where the Robustness Design Competition was very interesting for me. When I looked at the results of the competition as a jury member, my first reaction was: 'Why didn't we force students to work in a more cross-disciplinary manner? Why didn't we think of a formula in which they had to talk to an engineer, a fashion designer, or even an artist?' If we had, the outcome of the competition probably could have been more effective in encouraging cross-disciplinary thinking. The fact that so few people from the Britain entered the competition was also disappointing.
A theme like Robustness in relation to design and concrete is so abstract it is easily misunderstood.
On the whole, however, the Robustness Competition was a good first attempt. If we want this approach to succeed, it is very important that people who see announcements for future editions think of it in a credible way. Right now it's all about putting lots of strategies into place to generate momentum. We have to create the right conditions for a new way of thinking. It reminds me of the story someone once told me about Newton. When the apple fell on his head he wasn't thinking about gravity. It just happened that the apple fell, and he was able to create a whole theory based on what happened. What I'm saying is that if you put yourself in a position where something could 'fall on your head', chances are that you will make progress. Creating such an environment is what my work at Adams Kara Taylor and in schools for architecture is about.

Auditorium University Zürich



Renovation of Oskar Reinhart Collection, Römerholz, Winterthür

Residential superstructures, Broëlberg II, Kilchberg

THE 'FLEXIBILITY' OF CONCRETE

INTERVIEW WITH **ANNETTE GIGON** AND **MIKE GUYER** BY OLV KLIJN

Swiss architect duo Annette Gigon and Mike Guyer rose to prominence in the early 1990s with a string of surprising museum designs. By the mid-1990s their work started to become more clearly distinguishable from the Swiss context that is characterized by a predilection for purity and clarity. The work of Gigon/Guyer then started to reveal an interesting understanding of ambiguity. By 2004, thirteen years after the completion of the first museum, the work of Gigon/Guyer can best be described as original and individual. Their understanding of ambiguity now incorporates notions of complexity and artificiality, as we see subtle deformed geometry and artificially manipulated materials in their work. In its individuality, however, the work of Gigon/Guyer not only evokes new experiences but also refers to anonymous architecture – an important base and source of inspiration. In using methods also used in the discipline of art or collaborating with artists, Gigon/Guyer also often refer to art in their work. In an earlier publication, I already touched on the relation between the fascinating use of colour by Gigon/Guyer and the view of Robert Slutzky and Colin Rowe on the notion of 'transparency' as a '*continuous fluctuation of interpretation*' [1]

Within the context of the Concrete Design Competition Robustness and Master Class, I spoke again with both architects. We once again discussed the development of their work, but this time we left aside the issue of colour as much as possible. Given that Gigon/Guyer are the only interviewees not connected in any way to the Concrete Design Competition, I was particularly interested in their ideas about the current possibilities for (young) architects in general. I wanted to hear their views, as practising architects, on the current period, how they assess the architectural climate. In other words, the thrust of our conversation was: "As an architect, how do you develop your concepts, what tools do you deploy in that process, and which mental characteristics do you need to train for that purpose?" We met amidst the rattling slide-projectors installed in the exhibition *Gebaut / nicht Gebaut* that was on show in Zurich.[2] Gigon/Guyer stressed the continuity in their work and spoke of the slow development of underlying principles that often remain invisible to observers. As a result of this unclear process of

1 *Klijn, Olv*, De diepte van kleur, De Architect, October 2002.

2 This exhibition was organized by the *Architektur Forum Zurich* and was on show from December 9, 2004, to February 15, 2005, in Zurich, Switzerland.

development, a radical process of renewal in leaps and bounds would, from a distance, seem to be taking place. Yet the truth is that most ideas have been present in their work for a lot longer, but less obviously. We also discuss the mental flexibility that architects must develop to get their ideas realized.

THE COMPETITION

In contrast to the dominant view that the architectural climate, just like the global economic climate, has landed in a deep crisis since 9/11, our work in the recent period is marked by increasing diversity. Instead of a mood of crisis, we are in a state of excitement and enthusiasm. Although we have of course noticed that less has been built in recent years, in various projects we've had more scope to test our fascinations in reality. To observers, perhaps, our recent work might as a result seem more striking that it used to be, less typical of *Swiss box architecture*. But as far as we're concerned, little has changed. We're realizing the ideas that were latent in earlier projects, most of them competition entries. To highlight this continuity in our work, in our most recent overview exhibition – *Gebaut / nicht Gebau*t – we chose to really show our most recent 25 projects: competitions, built work, and current projects are displayed next to one another. An interesting aspect of this choice is that the competition designs in particular turn out to play an important role in understanding our development. In general, competitions are a familiar item in modern architecture. A well-known historical example is, for instance, the *Chicago Tribune Tower*, which various famous architects entered.[3] But for a long time publications and overview exhibitions on the work of architects concentrated on completed buildings. It was only in the 1980s, partly because of the poor economic situation, that there was any attention for 'paper architecture'.[4] In the 1990s the economic upturn meant that there was plenty of building going on and plenty of attention for completed work. What was new during this period was the growing interest in competition designs, even when these designs were destined to remain unbuilt. As a consequence of extensive media coverage, a number of 'losing' designs have been more prominent in the architectural discussion than the winning designs.[5] Yet, despite the increased attention given to competitions, the designs submitted remain shrouded in mystery within the architectural discipline. They are usually diagrammatic, surrealist and utopian designs, and if they don't lead to victory, these are the ones the makers want to forget as quickly as possible. For observers, there are always two sides to a competition design: mysterious as long as the competition lasts, but useless if they don't result in success.

But apart from victory or failure, delight or frustration, competitions take on a different dual importance for us as test case and breeding ground. They give us the chance to develop ideas and test them in new situations. Analysis of various competition designs supplies the missing puzzle pieces in the development of our body of work. Or, as Heinz Wirz quotes Goethe in his opening words for the exhibition catalogue: 'One can never grasp nature – or a work of art when it is already complete; one must catch a glimpse of it while it is emerging, in order to comprehend it at all.'[6] In an almost embryonic phase, ideas – concepts – discernible in our competition designs turn up more explicitly in completed projects. In the mid-1990s, for instance, we experimented with more complex geometry than a purely orthogonal volume, but only in 2004 have these experiments become visible in a dwelling design in Zurich. Looking back, we can trace the origin of this house to a first modest experiment with an 'angled' volume in our design for the competition for the Stadhauskeller in Aarau. In the competition for the Roche education centre in Buonas the experiment with irregular forms is continued.[7] The house in Zurich, however, was the first opportunity to make this idea in reality. Innovations, ideas in the form of competition designs, are very precious but of course not sufficient for us architects. Ideas must ultimately be realized to prove their quality.

OUTSIDE SWITZERLAND

In addition to experimentation through competitions, experiences with projects outside Switzerland are important for our development as architects. Working in a 'foreign' context has taught us much about notions such as locality, convention and flexibility. Although architecturally we see the emergence of a European vocabulary, we still notice that local traditions and regulations largely determine opportunities in the end. Our response in these situations is actually to try and integrate local construction methods and local knowledge of materials in our architecture. In doing so we can explicitly link our work to the context, and we can exploit and highlight local achievements and ideas that result in innovation.

The archaeological museum that we built near Osnabrück in Germany is a good case in point. We wanted to use steel as a construction material for different reasons: Firstly in order to build only light structures on soil still full of objects, to 'touch the ground lightly'. Secondly because steel with its different finishes – raw, rusty, oiled, or painted – relates to the history of this site because, as opposed to other building materials like concrete, steel oxidizes and deteriorates, thus illustrating the impermanence of material states and therefore also the passing of time. Thirdly, we built in an area where steal structures were common because they were used for the nearby coal industry. Nevertheless, a museum of Corten steel was difficult because at the beginning no-one would vouch that the steel wouldn't rust through and through.[8] The lack of guarantees meant that Corten steel was implicitly placed on a blacklist of building materials. Finally, Corten steel could be replaced with weather-resistant steel (a new product of the steel industry), and we developed a very refined way to mount the panels on the steel structure – normal, painted steel profiles.

A comparable consideration played an important role in the choice to build the Mouans-Sartoux museum in France in concrete. Concrete is a common material there, but the French contractors had to use new technologies for casting the concrete in unusually huge frameworks.

The housing scheme that we're now completing as part of the urban plan by OMA in Almere in the Netherlands has also provided a number of new insights. Here the adaptation of local conditions is

3 This competition was staged in 1922 by the Chicago Tribune as a publicity event and attracted entries from architects like Walter Gropius, Eero Saarinen, and Adolf Loos. The competition was won by the New York architect Raymond Hood. The design by Loos, in the form of a Doric column has for many people become a more familiar image that the building eventually erected by Hood.

4 Early in their careers in particular, architects like Pieter Eisenman, Bernard Tschumi and Daniel Libeskind were exponents of this form of architecture.

5 Various losing competition designs by Rem Koolhaas/OMA are more prominent in the architectural debate that the winning designs. Examples include the designs for Parc de la Villette and Jussieu.

6 Goethe in a letter to Carl Friederich Zeltner, cited here is *Wirz, Heinz, De aedibus 7 – Notat*, in *Projects Gigon / Guyer*, Quart Publishers Lucerne, 2004.

7 In this design our ideas on the use of concrete – the material is usually poured in layers or produced in components – to an expressive facade in which various layers of concrete remain visible like layers of sediment.

8 Corten steel, or weather-resistant steel is a type of steel that can be used untreated because the rusty-brown layer of oxidation on its surface protects it against further oxidation. That's the idea in theory at least. In practice, however, there have been various cases in which this type of steel has actually rusted more rapidly than other types of steel.

less explicitly visible in the materials, but the floor plans of the houses are designed to be built with tunnel formwork, a condition we never had in Switzerland. Beyond all that, one of the innovations in this project is an almost trivial architectural detail: the use of sliding doors in high-rise. In Switzerland it is very difficult to specify sliding doors with French balconies in high-rise structures, but in Almere no such restrictions apply, and that opened up new possibilities.

HISTORY OF CONCRETE

As we said, over the past ten years we've had a greater variety of projects to work on and, in addition, our arsenal of possible architectural 'answers' has increased accordingly. But the expansion of our architectural vocabulary is not just the result of demands from clients. It is certainly also due to technical changes and innovations that are the outcome of combining our ideas with the labour of skilled craftsmen. Examples of such innovations that lead to new architecture are the prefabricated concrete elements with copper powder as an ingredient at the Museum Reinhart in Winterthur, the newly developed windows for the project Broëlberg 1, the Two Houses in Zürich, the concrete floors in housing projects at Susenberg and Pflegi, and the layered concrete for the auditorium in Zürich. As architects, we can do research only on the (small) scale of a project because we are reliant on the willingness of clients and contractors to take risks. This form of research, however, is usually the most rewarding because it has the highest chance of resulting in tailor-made solutions. To a much lesser extent, unfortunately, the process of an expanding vocabulary is also the result of innovation from within the building industry itself.

Yet our development as architects can be told by reference to the recent history of a material like concrete. In 1993 and 1994 we tried to make the size of doors and windows in concrete structures as big as possible in various housing schemes. This gave us greater compositional freedom, but the use of pure concrete in the facades of (residential) buildings remained expensive because in practice it meant that the same facade has to be built twice, once as load-bearing structure and again as an outer skin with a layer of insulation between the two. Cost considerations meant that concrete was mainly used as a structural material 'inside' buildings. Insulation material was then attached to the concrete structure and the whole building was finished in plaster. Apart from a few exceptions – Andrea Deplazes for instance[9] – nobody seriously attempted to use concrete as both a structural and insulating finishing material. Only in exceptional buildings, therefore, was it possible to deploy a facade made up of two layers of concrete. Recently the possibilities have expanded by turning the traditional structural method inside out. The combination of a structural outer facade of concrete with insulation and plaster inside and large facade openings resulted in some of our dynamic and sculptural buildings such as the Museum Albers-Honegger in France, the Workshop buildings in Appisberg, Männendorf, and the House in Zürich.

One of our most recent buildings in Zürich highlights another fascination of ours when it comes to concrete: the casting process.

9 Andrea Deplazes – partner in Bearth & Deplazes – has used concrete as a structural and insulating material in projects such as Haus Meuli, in Fläsch, Switzerland, by making facades 95 cm thick.

We always think of concrete as a fluid form of stone. Although the stony quality and formless character receive most attention, in various projects and competitions we have experimented with the process of pouring concrete. In the Hörsaal for ETH this experiment has become part of a completed building. Subtle colour differences in the concrete facade reveal the various horizontal layers in which the concrete was poured.

In addition to new possibilities for in-situ concrete, we're also interested in the use of prefab components. Amazing examples from the 1960s and 1970s have shown that this technology can also lead to interesting results. For us the use of prefab techniques is relatively new, and we're currently researching its possibilities.

THINKING AS CONCRETE

Considering all that has been discussed, I (OK) think it's critically important for architects to develop a way of thinking that can deal with change. Given the view of the dual function of competitions, architectural concepts, as far as Gigon/Guyer are concerned, need an incubation period and they must be flexible enough to accommodate change until the opportunity arises to apply them in a building.

Architects therefore must be able to think in a flexible manner if they are to innovate in these conditions. In the case of Gigon/Guyer, one could illustrate this process of thought by taking their beloved material concrete itself as a metaphor. Once built, concrete stands for inertia and indestructibility through external forces, but during construction no other material is as 'open' to manipulation as concrete. In unique fashion even the ingredients of this material can be determined by architects, it can be coloured and its physical properties significantly altered – even after being cast. In a striking way, this versatility of concrete is very similar to the demands that Gigon/Guyer put on their architectural ideas. Just as concrete is robust because of its 'ability to adapt', their architectural ideas must also be robust enough to withstand the lengthy process of ripening and waiting.

111

LEXICON

AERATED CONCRETE (AXIS 1.3) Very light weight concrete. Industrial production in autoclaves, cut into panels and blocks after demoulding. Easy to treat with handheld tools. Unique combination of thermal insulation and inflammable construction material. Low strength capacities. Durable. Restricted load bearing capacities.
Compressive strength (range): 2-5 N/mm2
Tensile strength (range): 0 N/mm2
Weight: 600-1200 kg/m3

BIG TEN BURRITO [Ply Architecture Brochure] 'Experiments for the BTB interior emerge from a series of questions about the relationship between the craft of making and new technologies of digital fabrication. These new methods are often employed in the fabrication of complex forms which often result in inordinately large quantities of wasted material as the complexity of form precludes the efficient use of standard, flat 4' x 8' sheet products. This project illustrates our desire to produce complex formal and spatial readings with an economy of means while allowing the plywood panels to retain their integrity. The joint and surface are of particular interest as a means of simultaneously articulating and obscuring their individual reading in an effort to create an intimate space with sensuous materials.'
Interior design, fabrication and installation of the BTB restaurant, Ann Arbor, Michigan, USA by Ply Architecture (Karl Daubmann & Craig Borum, principles and Carl Lorenz, Pete Stavenger, Maria Walker), 2003 – 2004. Materials include: custom fabricated ceiling and wall panels CNC surface routed red Finform plywood. Custom fabricated service counter CNC surface routed birchwood. Custom fabricated pendant lights, laminated birch veneer plywood.

CHARACTER [Annette van Framqué / Sladan lapadatovic / David Szajak, Do You Have a ROBUST Character?, CDC ROBUSTNESS HK318] 'Do you have a ROBUST character?
Do you follow your principles?
Do you believe in yourself?
Do you have your own style?
Do you resist the mainstream?'

The surface pattern routed into the red plywood was studied in relationship to the technique and the resulting effect. A round bit was used because as the depth of the cut changes, so does the width of the cut. The larger pattern of the ceiling relates to its program. A zone for lights is defined by moving the grooves closer together. The NVAC diffuser is defined by moving the grooved further apart and cutting all the way through the material. The grooves intentionally disregard the limitations of the sheet size to bias the zone defined by the pattern over the tectonics of the constructional logic. A series of CNC routed plywood tiles were developed for the face of the takeout counter. The tiles were designed to form a seamless surface while the joints and lamination contours inform the perception of the whole object.

COLOUR [Jef Apers – Febelcem] 'Concrete, whose surface is not subjected to further processing after the removal of the formwork, has a "skin" composed of the finest elements of the material. It is the colour of these fines that determines the colour of the concrete skin. The colour becomes increasingly intense and dominant as the diameter of these fines falls. Here their large numbers mean that the hydrated cement fines play an important role. All kinds of colours can be obtained using pigments and specific fine sands, where mainly the filler fraction is important (< 0.08 mm). Metal oxide mineral colorants are the most effective because of their long-term stability. Pastel colours can be obtained by adding 1 percent of pigment to the cement content, deep colours can be obtained by adding 5 percent. The addition of yet more pigment serves little purpose.
When white cement is used the ultimate colour will be light and intense, when grey cement is used the colour will be greyer and darker. The metal oxide content of the grey cement causes the grey tint. The colour becomes darker as the oxide content of the cement rises. As this content is dependent on the type, class, and make of the cement, differences in grey content are inevitable. They can be limited by using the same sort of cement of the same brand for all the panels of the building. Another solution is to use textured concrete (for example creating a relief with a texture mat), so that shadowing makes the differences in grey tint less noticeable. The problem is non-existent when white cement is used, as it contains no oxides. This option is thus obvious choice when using light coloured concrete.
Colour clarity also depends on the size of the surface grains in the cement. Large grains are often rough and absorb more light than fine grains. The degree of compaction is also important. The surface colour will become darker as compaction increases and the texture is denser. Finally the lime released during hydration also affects clarity.
The uniformity of the colour clarity is dependent on the homogeneity of the composition of the concrete skin, which is in turn largely dependent on the consistency of dosage and the methods used for casting and vibrating the concrete. Another major influence is the water to cement ratio. Even a limited degree of variation will result in differences of clarity. The cement skin of the areas with a low water to cement ratio will be compacter, denser and thus darker. Zones with a higher water to cement ratio will be lighter.
If the external skin is removed, for example by polishing or stripping, the internal structure of the concrete will be visible. The colour or shade will then be determined by the finest elements, i.e. the cement, sand fines, any pigment, and by the aggregate skeleton. There are so many different kinds of fine and rough aggregates on the market that it is possible to obtain virtually every shade of colour imaginable.'

CONCRETE [Hans Köhne – ENCI, Concrete – liquid stone / stone of art]
'Concrete is a structural building material. Typical structural behaviour and properties of concrete are:
- high compressive strength
- restricted tensile strength

• perfect combination with steel reinforcement (same thermal expansion)
• solid, stable, durable.

The restricted tensile strength can be improved by reinforcement (fibres, bars) or compensated by prestressing (cables, bars). Basic choices in structural engineering design are:

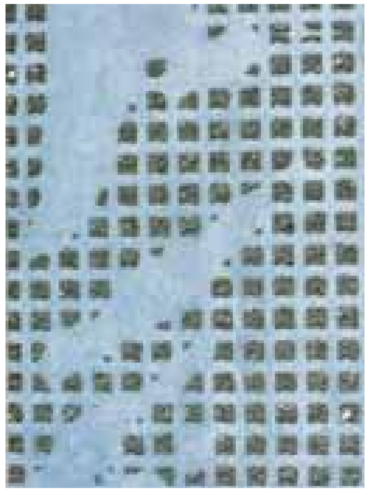
• non reinforced concrete
• reinforced concrete
• prestressed concrete

DESIGN [Hans Köhne _ ENCI, Concrete – liquid stone / stone of art] 'Concrete is a design(ed) material.
Architectural concrete has to be designed in many aspects. Several experts have to collaborate to find the optimum of all possibilities:

• material mix design, by the concrete technologist
• surface texture design, by the architect or artist
• structural design, by the structural engineer
• shape / form design, by the architect or sculptor
• the production technique, by the industrial producer.

EXPOSURE OF AGGREGATES – complete or partial removal of skin, intact visual aggregates (AXIS 2.2) [Jef Apers – Febelcem] 'The aim of washing away (stripping) the concrete skin is to make the usually coarse aggregate visible. This means that the shape, type, colour, grain size and grading of the aggregate are all relevant.
There are various ways in which the concrete surface can be stripped. If the surface is not enclosed by formwork, a hydration retarder can be sprayed on the surface and the concrete can be subsequently washed to remove the surface layer. For surfaces enclosed in formwork, it will be necessary to smear or spray the contact surface of the formwork with an agent that slows or prevents the hydration of the surface layer. The most recent generation of surface retarders have a controlled depth effect. They adhere very well, so that they can be applied to both vertical and inclined surfaces. Their effect is not influenced by the duration of the contact with the concrete mix. There are various sorts, which can be classed by their degree of retardant effect (from weak to strong).'

EXPOSURE OF AGGREGATES – complete or partial removal of skin, treated visual aggregates (AXIS 2.3) [Jef Apers – Febelcem]
'*Etched surfaces*
Concrete skin consists primarily of hydrated cement particles. Acid attacks this alkaline environment. When an acid treatment is applied it gives rise to a micro texture. The intensity of the treatment and the nature of the aggregate determines what this texture will look like. The first of these determines the depth of attack, while the second determines how rough the treated surface will be.
Silicaceous aggregate is not affected and gives rise to a grainy surface. Limestone aggregate on the other hand is affected and treatment results in a more even texture.
Acid treatment can be applied in two different ways: either by immersion in an acid bath, or by the application of an acidic gel. The first method is associated with certain drawbacks, including the fact that it is difficult to determine the exact immersion time for a given effect, and that the entire element must be immersed. The



'This technique has been improved and developed in such a way that it is becoming possible to 'print' graphic illustrations on the concrete.'

latter means that all sides of the element are exposed to the acid as well as any protruding reinforcement and the suspension system.
The use of an acidic gel means that only the surface to be etched is exposed and it is easier to produce uniform results. Gel must, however, be brushed on and is consequently labour intensive.
After treatment (either by immersion or with gel) the surface must be copiously flushed with water.

Blasted surface
High pressure blasting with sand or steel grit erodes the surface. Either the sand grains or the coarse aggregate can be rendered visible depending on the hardness of the grit and the duration of blasting. The result is a rough, angular and matt surface.

Polished surface
The colour palette of the coarse and fine aggregate embedded in the cement matrix can be fully revealed when the concrete skin is ground away to a depth of 2 to 3 mm and then polished to provide a new skin. The final result depends on various factors, with composition and treatment being the most important.
The first step is to remove 2 to 3 mm using a diamond grinder or a coarse grinding wheel. The result is a rough surface containing a number of irregularities, such as grooves in the aggregate and the cavities caused by air bubbles. A finer grinding wheel is then used to remove the grooves and these voids. This roughened surface is then filled with cement paste (or a mixture of cement and resin) and polished after curing. All the cavities and pores will now have been filled. The resulting improved surface can now be polished smooth and given a glossy surface. Treatment with increasingly finer polishing wheels results in a matt or satin gloss effect, while continued polishing results in a high gloss.
Factors to be considered when selecting the aggregate include the form, size, grading (continuous or discontinuous), and hardness. Both relatively soft aggregates such as calcite, slate and marble and harder stones such as quartz, granite and porphyry can be considered. The colour variation of the first group is greater than the second. A soft aggregate surface will only take a high polish after extended polishing.
Moreover, when used outside the polished effect is vulnerable to attack by (acid) rain. It is easier to achieve a high gloss with hard aggregate. Moreover such a polish will be more durable in an aggressive atmosphere.
Here the composition of the concrete is extremely important, with preference going to a very low water to cement ratio in order to achieve the lowest possible porosity and a minimal cement matrix that is just sufficient to fully embed the fines.

Dressed surface
It is possible to dress the surface in all sorts of ways using a granulating hammer, a pointed hammer, a chisel or a diamond cutter.'

FASCINATION [David Bowie /Luther Vandross, Fascination, Young Americans]
'Every time I feel fascination
I just can't stand still, I've got to use her

Every time I think of what you pulled me through, dear
Fascination moves sweeping near me
Still I take ya'

FORMWORK [Hans Köhne – ENCI, Concrete – liquid stone / stone of art]
'Design and production of the concrete materials mix is one. Design and production of the formwork is another. Using the best materials and techniques for the formwork is the key to success in architectural concrete. The formwork is essential for
- concrete shape and surface quality / texture
- concrete production costs.

Reuse of formwork will reduce the costs. That means repetition of elements.
- Complex concrete shapes require complex formwork.
- Complex (3-dimensional) formwork can be difficult to demould.

Traditional formwork materials are:
- plywood sheets
- steel sheets

Recent development is the connection of architectural design and structural design to formwork production, by the use of digital drawing files, the so-called CAD/CAM technique.
This enables the milling of complex shapes in more or less flexible materials as:
- polystyrene / polyurethane
- This lightweight material can be used as an infill in boxes from plywood or steel.'

FUTURE [Emre Çetinel, CONCRETE TECH-SURFACE +S, CDC ROBUSTNESS BE358] 'In the cases of advanced technology, concrete won't be of as much use in the future. Concrete will have to meet demands of humanity. Concrete cannot exist in a rigid, unchangeable structure during a period of time with fast changes and short intervals.
In the future, the use of concrete will depend on what it is needed for. Expectations about new concrete should be flexible…'

GENERIC STANDARD CONCRETE (AXIS 1.1) Used for day-to-day applications, precast or in situ. From small pavement blocks and roof tiles to giant columns and spatial structures.
Restricted strength capacities. Durable.
For heavy loading situations the concrete dimensions can be rather voluminous.
Compressive strength (range): 20-50 N/mm2
Tensile strength (range): 1-2 N/mm2
Weight: 2300-2400 kg/m3

HYBRID [Hans Köhne – ENCI, Concrete – liquid stone / stone of art]
'Concrete is a composition.
basic materials, for making stone
- aggregates (sand and gravel / fine and course)
- cement (hydraulic binder)
- water

additional materials, for influencing mechanical behaviour, strength
reinforcements (fibres, bars)
- fibres (glass, polypropylene or steel)

extra materials, for influencing rheologic properties in liquid phase, durability
- chemical additives (retarders, plasticisers, air-entrancing agents etc.)
- fillers (fly ash)
- for influencing the surface qualities (colours and textures)
- pigments
- fillers (limestone meal)
- anything you like to add (glass particles, foam, plants . . .)'

IMAGINARY CONCRETE (AXIS 1.4) Can afford all properties you have dreamed of, but never dared to ask for.
But it has to be cementitious, that means a manmade stone based on the use of a hydraulic binder.
A fantastic material that does make sense; a designed material that inspires the professionals to rethink their basic assumptions.

INFINITY [Emre Çetinel, CONCRETE TECH-SURFACE +S, CDC ROBUSTNESS BE358] 'Surely, infinity (immortality) means robustness.'

INNOVATION [Rosabeth Moss Kanter, e.o., Innovation] 'A universal characteristic of innovative companies is an open culture. A culture that reaches out to relationships in all directions: across functions and departments internally, and with every potentially beneficial external connection.'
'Be prepared for a lot of conflict. Innovation is messy. There's a constantly shifting set of agendas. It's very difficult to manage.'
'There's a tendency to romanticize innovation – to think it's synonymous with intuition. Wrong. Innovation requires an incredible amount of sheer brain power. Intellectual smarts. An ability to hold more than one idea in your head at the same time, to understand contradiction, to listen to many voices.'
'… It happens at the fringes, in out-of-the-way places, away from the dampening influences of bureaucracy and politics.'
'The innovative process has three major components. The first is invention – getting ideas. The second is development – turning ideas into reality. This stage calls for extraordinary discipline and focus. The third stage is getting the product on the market and making it a huge success. This stage – which includes distribution, pricing, marketing, and public relations – demands integration.'
'Companies need resilient people who can tolerate the inevitable ups and downs.'
'I don't think any company should hire people who aren't self-starting, who need regular deadlines and constant hand-holding.
You want people who embrace uncertainty, take initiative, and aren't afraid of projects that have no immediately discernible direction.
'Curiosity is the foundation, the soul of innovation. You want people who are voracious for information, and not just about their potential bailiwick but about the whole company. Look for how they accept and absorb information. Do they pose follow-up questions? Do they challenge a piece of information?'

INTELLIGENCE [Webster's Third New International Dictionary] '… 1 a : the faculty of understanding: capacity to know or apprehend…'
'…to use one's existing knowledge to meet new situations and to

solve new problems, to learn, to foresee problems, to use symbols or relationships, to create new relationships…'
'…ability to perceive one's environment … to deal with it effectively, to adjust to it…'

KNOWLEDGE [Israel Rosenfield, The Strange, Familiar and Forgotten]
'Knowledge is the brain's ability to organize itself in particular ways at particular times.'
[Paul Feyerabend, Against method] Knowledge so conceived is not a series of self-consistent theories that converges towards an ideal view; it is not a gradual approach to *truth*. It is rather an ever increasing ocean of mutually incompatible (and perhaps even incommensurable) alternatives, each single theory, each fairytale, each *myth* that is part of the collection forcing the others into greater articulation and all of them contributing, via this process of competition to the development of our *consciousness*. Nothing is ever settled, no view can ever be omitted from a comprehensive account.'

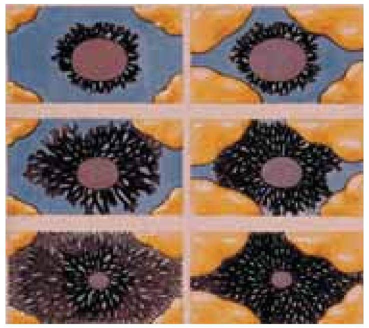
METAMORPHOSIS [Hans Köhne – ENCI, Concrete – liquid stone / stone of art]
'The different phases or steps in the mix lead to a real metamorphosis, from dry to liquid to hardened:
- dry mix, unbounded particles
- wet mix, plastic phase of fresh concrete
- hardened concrete

Some time after mixing cement and water, a chemical reaction starts, called cement hydration. The hydration process will finally result in hardened concrete stone, insoluble in water. The reaction speed mainly depends on temperature. The final strength level mainly depends on the water/cement ratio (more water = less strength). Also the workability or fluidity of the wet mix depends the water/cement ratio (more water = higher fluidity).
Casting or pouring the wet mix has to be done in the period between mixing the dry mix with water and the beginning of the hydration process. The open time is about one hour.
During the hydration process the concrete will harden. After 7 days at normal temperature 70% of the final strength can be reached.'

PHILOSOPHY [Gilles Deleuze / Felix Guattari, What is Philosophy?, Verso, 1994] 'philosophy is the art of forming, inventing, and fabricating concepts.'

PLASTIC [Hans Köhne – ENCI, Concrete – liquid stone / stone of art] 'The plastic phase is essential for the structural and architectural properties of concrete. It is also a critical and risky phase, because in this phase the concrete is liquid. It can be poured, it can be shaped. The process of hardening and strength development can be damaged and disturbed by temperature, movement, chemicals.
To ensure the outcome of a well shaped, strong concrete product, there is a need for
- a firm, stiff, stable formwork or mould
- time to bind and harden
- prevention of drying (hydration process will stop in case of early drying)

Inherent to the hydration process is some shrinkage of the material volume. This can be cause of crack formation. To prevent or restrict



crack formation, restrictions are necessary in concrete dimensions. Reinforcement (fibres, bars) is used to prevent crack formation in large elements.

RICHTER [Robert Storr, Gerhard Richter, Forty years of Painting, The Museum of Modern Art, New York, 2002] 'Gerhard Richter is one of the most influential painters working today. Since the early 1960s, his work has received much attention and many international accolades. Richter's diverse body of work calls into question such widely held assumptions as the importance of stylistic consistency, individual artistic sensibility, spontaneous creativity, and the impact of technology and media imagery to traditional studio methods and formats. Unlike many artists today, he has explored these issues mainly through the medium of painting, challenging it to meet the demands posed by new forms of conceptual art. His varied output ranges from austere photo-based figurative realism of the early 1960s to brightly colored gestural abstractions of the early 1980s and encompasses such startling works as his brilliant cycle of black-and-white paintings of the Baader-Meinhof group, thought-provoking monochrome abstractions and banal Pop images, delicate landscapes and intimate portraits. As an artist, Richter has assumed a critical distance from vanguardists and conservatives alike regarding what painting should be; and the result has been a vital renewal of painting itself.'

ROBUSTNESS [Santa Fe Institute, New Mexico, Working Definitions of Robustness, http://discuss.santafe.edu/robustnesss/stories/storyreader$9]
'Any or all of the below:
2. Robustness is the ability of a system to maintain function even with changes in internal structure or external environment. [See e.g. Fontana and Wagner " Mutational Robustness"; M.Sheets, "The Cell as a Machine"; Callaway et al "Network Robustness and Fragility"; Scientific Committee on Antartic Research "Regional Sensitivity to Climatic Change in Antarctic Terrestrial Ecosystems".]
3. Robustness is the ability of a system with a fixed structure to perform multiple functional tasks as needed in a changing environment. [See, Saunders, "Design Computing and Autonomous Robotics"].
6. Robustness is the degree to which a system is insensitive to effects that are not considered in the design [Slotine and Li, "Applied Nonlinear Control"].
10. Robustness is the ability of software to react appropriately to abnormal circumstances (i.e., circumstances outside of specifications including new platforms, network overloads, memory bank failures, etc.). Software may be correct without being robust [Object-Oriented Software Construction]
12. Robustness is a design principle of natural, engineering, or social systems that have been designed or selected for stability.
16. Robustness is a characteristic of systems with the ability to heal, self-repair, self-regulate, self-assemble, and/or self-replicate [See e.g., "Mimicking Biological Systems, Composite Material heals Itself"; Harvard Medical School, "Healing the Brain from Inside Out"; IBM "Autonomic Computing; or "The Embryonics Project".]
17. The robustness of language is a measure of the ability of human speakers to communicate despite incomplete information, ambiguity, and the constant element of surprise. [Brisco, "Robust

Parsing," in "Language Analysis and Understanding" (A. Zaenen, ed.), *Survey of the State of the Art in Human Language Technology.*]
18. None of the above.

SKIN [Jef Apers – Febelcem] 'The interior of any concrete element is hidden behind a skin. This skin conceals the internal stresses that allow the concrete to serve as a support or span, and protects it against environmental influences. It is the supporting surface for countless functions and demarcates space. It conceals both monolithic masses and slender, decorative and daring forms. It provides for structural and plastic expression. It reveals the play of colour and light and confers decorative refinement on the concrete. The skin is composed of closely agglomerated cement particles. This skin may also be removed to reveal
the interior of the concrete. Numerous treatments exist.'

SMOOTH SURFACES *(not treated, not structured)* (AXIS 2.1) [Jef Apers – Febelcem] 'Obtaining smooth concrete with a surface that is as uniform as possible is one of the most difficult tasks of all. It requires extreme precision during mixing, the greatest of care when processing, and perfect formwork.
Another aspect that the manufacturer must pay attention to is the avoidance, as far as possible, of the formation of surface voids as a result of the enclosure of air. Here the composition of the concrete, the releasing oil used, the material used on the surface of the formwork, and the methods used for casting and vibrating the concrete all play a role. Sometimes joints and centre pinholes are marked out.

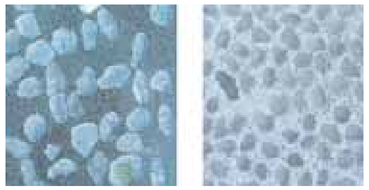
SOPHISTICATED CONCRETE (AXIS 1.2) Very high strength capacities. Durable in extreme conditions.
Useful for slender columns.
Sophisticated production techniques, precast.
Self compacting in the plastic phase, useful for secure production of complex 3D shapes and filigree structures.
Compressive strength (range): 100-200 N/mm2
Tensile strength (range): 5-10 N/mm2
2400-2500 kg/m3

SPECIAL SURFACES (AXIS 2.5)

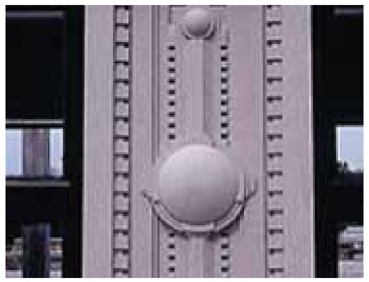
STRUCTURED SURFACES (AXIS 2.4) [Jef Apers – Febelcem] 'Complex parts (patterns for example) are made using "texture mats" (plastic mats or reliefs). Panels of great complexity can be cast in plastic moulds.'

THEORY [Webster's Third New International Dictionary] '... 1 archaic : imaginative contemplation of reality : direct intellectual apprehension : insight...'
'2 a : a belief, policy, or procedure proposed or followed as the basis of action...'
'2 b : an ideal or hypothetical set of facts, principles or circumstances...'
'3 a : the body of generalizations and principles developed in association with practice in a field of activity ... and forming its content as an intellectual discipline : pure as distinguished from applied art or science...'
'5 : something taken for granted...'

All kinds of colours can be obtained by using pigments and specific fine sands (filler fraction).



Example of adding big and small glass particles



Example of prefab element cast in wooden mould with 'texture mat'

TYPOLOGIES [Hans Köhne – ENCI, Concrete – liquid stone / stone of art]
'Concrete typologies are made in various ways, mostly based on very obvious distinctions, like weight, strength and production technique. Such typologies are relevant for approval or choices in standard situations. For the Concrete Design Master Class we needed another typology, one that offers as much distinction as possible. We introduced rather extreme concrete types. The following division in concrete typologies - that is not consistent and has never been published before – turned out to be useful:
- generic standard concrete
- sophisticated concrete
- aerated concrete or foamed concrete
- imaginary concrete

VANGUARD [Webster's Third New International Dictionary] 'avant garde'
'...2: the leaders of thought, taste or opinion in a field (as art, letters or politics) : the forefront of a school or movement...'

CONCRETE DESIGN MASTER CLASS ON ROBUSTNESS

Driven largely by technological innovation, the last decade of the 20th century saw the emergence of what many now call the 'knowledge society'. Knowledge and the raw material from which it is constructed – information – became the most precious resource of governments, companies and individuals alike as they struggled to remain competitive in a rapidly globalizing world. One of the most relevant changes for design in this period occurred with a new relationship between thinking and doing that emerged with new forms of prototyping. Whether through scenario planning, product rapid prototyping or digital spreadsheet modelling, prototypes were no longer considered final products but means of thinking by doing. As MIT Media Lab Professor Michael Schrage wrote at the time: Converting product ideas into crude mock ups and working models turns traditional perceptions of the innovation cycle inside out: instead of using the innovation process to come up with finished prototypes, the prototypes themselves drive the innovation process. In this way, thinking and doing, research and fabrication, and design and designed object become blurred, interactive and non-linear. Design becomes a living, continuous process of creating and testing and as a result more ROBUST. [Michael Speaks]

The Concrete Master Class on Robustness has targeted a set of objectives ranging from theory on design practice to research into material and general notions of ROBUSTNESS.

Dissolving the distinctions between theory and practice
There is no direct and linear relation between theory or concepts and design, in the sense that theory precedes practice or vice versa. The design process incorporates theory. Any distinction between thinking and making disappears. Thinking becomes making; making is thinking.

Rapid Prototyping
The unconventional design method of rapid prototyping allows designers to generate and analyze many different possibilities. Instead of focusing research on a few specific results, designers can deploy rapid prototyping to consider seemingly impossible or outrageous variations. A wide area of investigation can thus be covered quickly, opening up the design process to truly unexpected possibilities.

Material research
The master class was driven by material research into different types of concrete. The aim was to uncover the potential of the materials under very different circumstances. Both new and existing materials were introduced in order to investigate the implications of their use for all aspects of architectural design, such as form, program, functionality, and so on.

ROBUSTNESS
The assignment for the master class asked for the redevelopment of existing architectural details. These so-called 'primitives' had to be reconsidered and tested using different types of concrete under a variety of conditions. A wide range of possibilities for using concrete therefore had to be explored. The structure of the master class, the research and design techniques involved (rapid prototyping combined with material research), introduced the participants to a robust design approach. The class was open to innovation and to the personal fascinations that included the participants' work on their own competition entries. The master class thus encompassed a whole host of perspectives on ROBUSTNESS generated by the participants themselves.

Working in groups of 5 to 6 people, participants investigated the given 'primitives' through a matrix made up of three axes. One specific area of investigation was represented on each axis.
Axis 1: MATERIAL held four different types of concrete ranging from a standard mortar through fibre-reinforced self-compacting cement to 'imaginary concrete' in which seemingly impossible but essential properties could be projected.
[Generic Standard Concrete / Sophisticated Concrete / Aerated Concrete / Imaginary Concrete]
Axis 2: TACTILITY indicated five different types of surface treatment for concrete. This axis dealt with the formal exterior of architecture. Concerns with formwork, poured and prefabricated concrete were important issues on this axis that ranged from 'straight out of the mould' to treatments that open up the inner structure of mortars.
[Smooth Surfaces / Exposure of Aggregates – intact visual aggregates / Exposure of Aggregates – treated visual aggregates / Structured Surfaces / Special Surfaces – special aggregates]
Finally Axis 3: CONTEXT offered associative inputs for each prototype. Five paintings from Gerhard Richter represented his 'prototyping' practice in which he continuously investigates materials and techniques and, just as importantly, their relations to the actual paintings in terms of representation, formal language and so on. Without any specific directions but the paintings themselves, the participants could either interpret them literally in terms of object or subject or let them act as catalysts for their own associations and fascinations.
[Apple Trees, 1987, oil on canvas, 72 x 102 cm / Reading, 1994, oil on linen, 72,4 x 102,2 cm / Woman Descending the Staircase, 1965, oil on canvas, 200,7 x 129,5 cm / Abstract Painting, 1997, 36 x 51 cm / Abstract Painting, 1997, 55 x 48 cm]

After exploring each primitive through most of the 125 positions on the matrix, each group chose to develop one prototype for production at scale 1:1. During the 'matrix' investigation a number of experts assisted participants on subjects like concrete techniques, CNC software applications, and general design skills. Scale models were produced with the help of Delft University of Technology. Made using CNC-milling and 3D-printing techniques, these models represented scaled versions of prototypes, and details of these prototypes. Perhaps even more importantly, they enhanced understanding of the implications of the techniques on possible end products. Surface conditions and restrictions on possible forms were among the issues studied and tested. The proposals for the final prototypes were presented at the end of the master class in the form of models – some of them in concrete – sketches and 3D renderings. A team of software experts translated the proposals into sets of working files for TwinPlast, a Belgian CNC milling company, which produced the moulds.

The moulds were then sent to different locations for the production of the actual concrete objects. This was the final test in an exhaustive period of research into what Robustness can mean for the practice of architecture.

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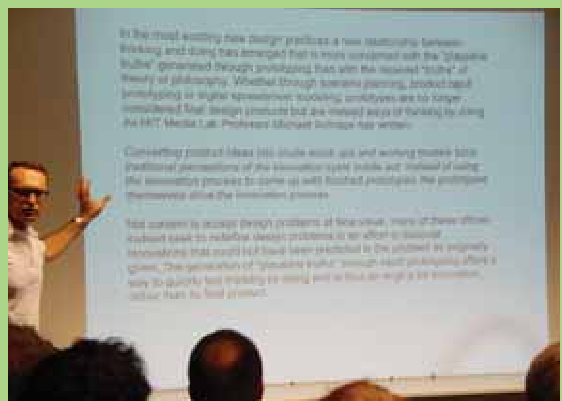

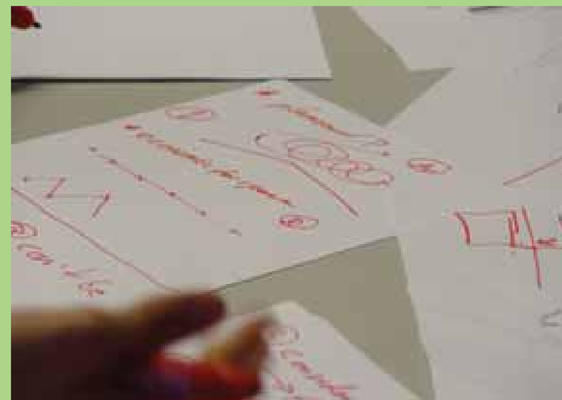

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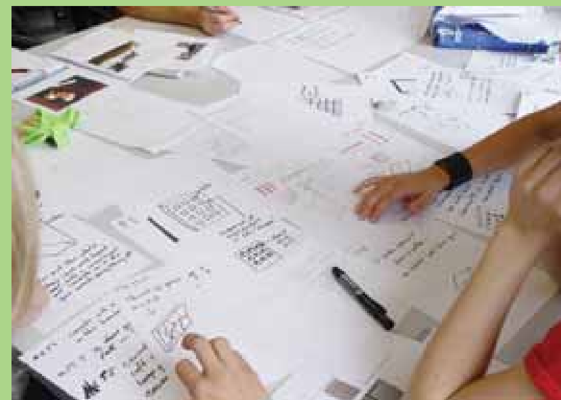


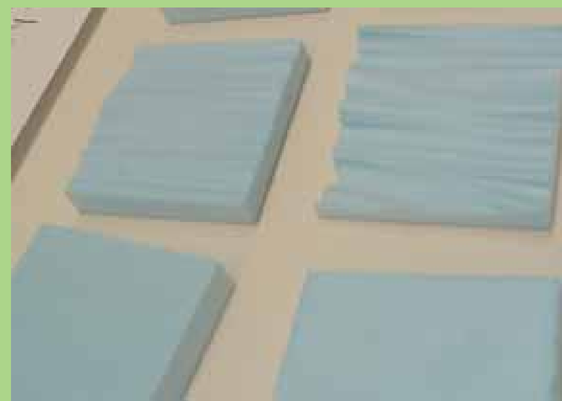




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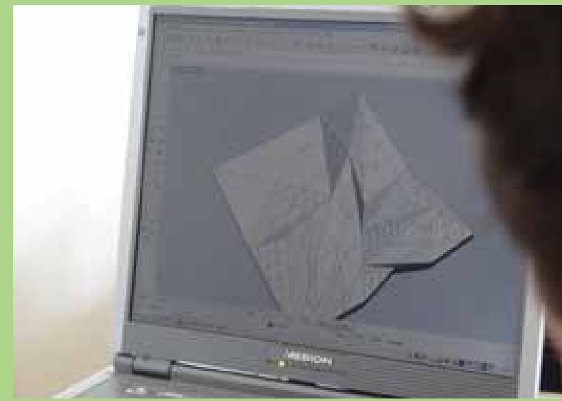

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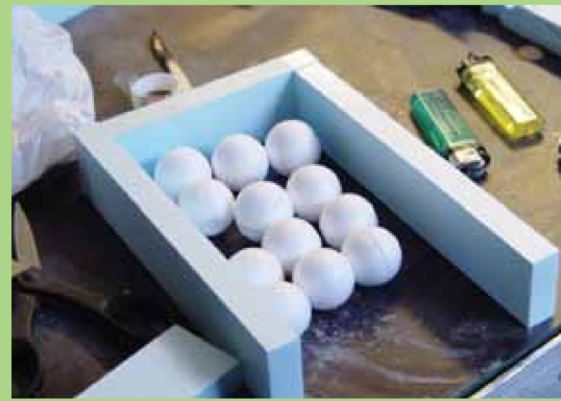

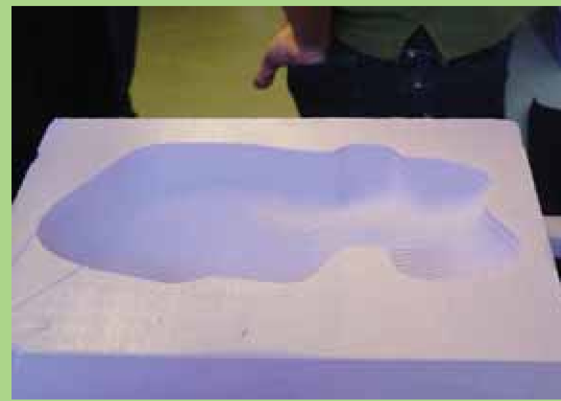

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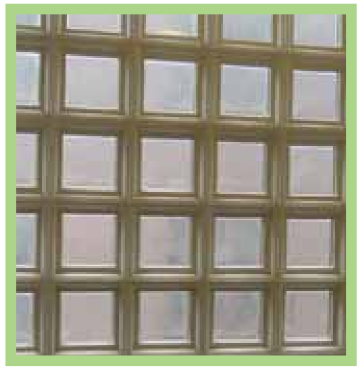
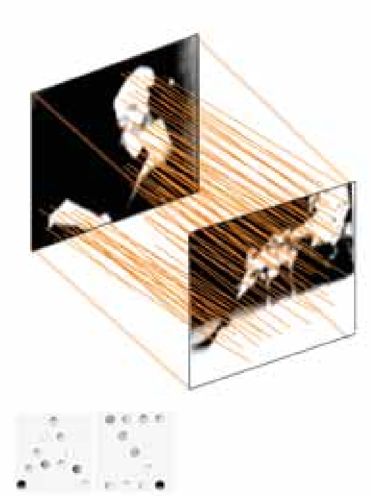
GROUP 1

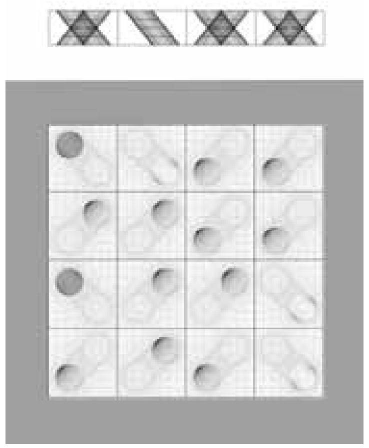
Francesca Crosby, Luis Pedro Ferraz Marques, Sebastian Kreusch, Markus Krunegård, Nils Nolting, Onur Sariyildiz

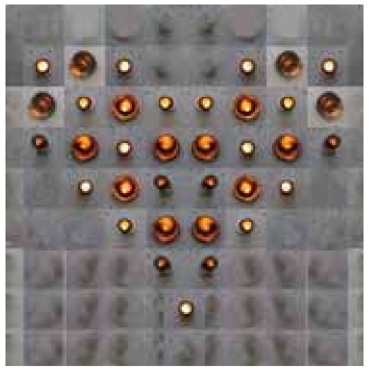


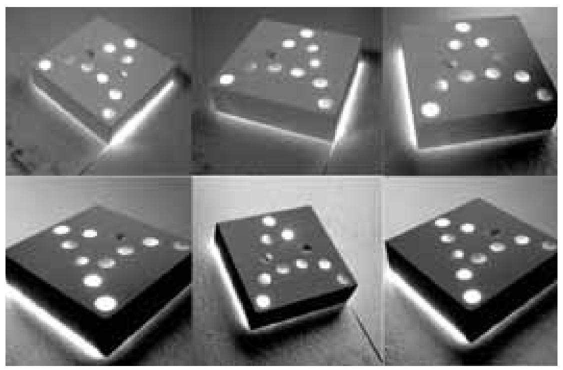
Primitive: glass brick facade

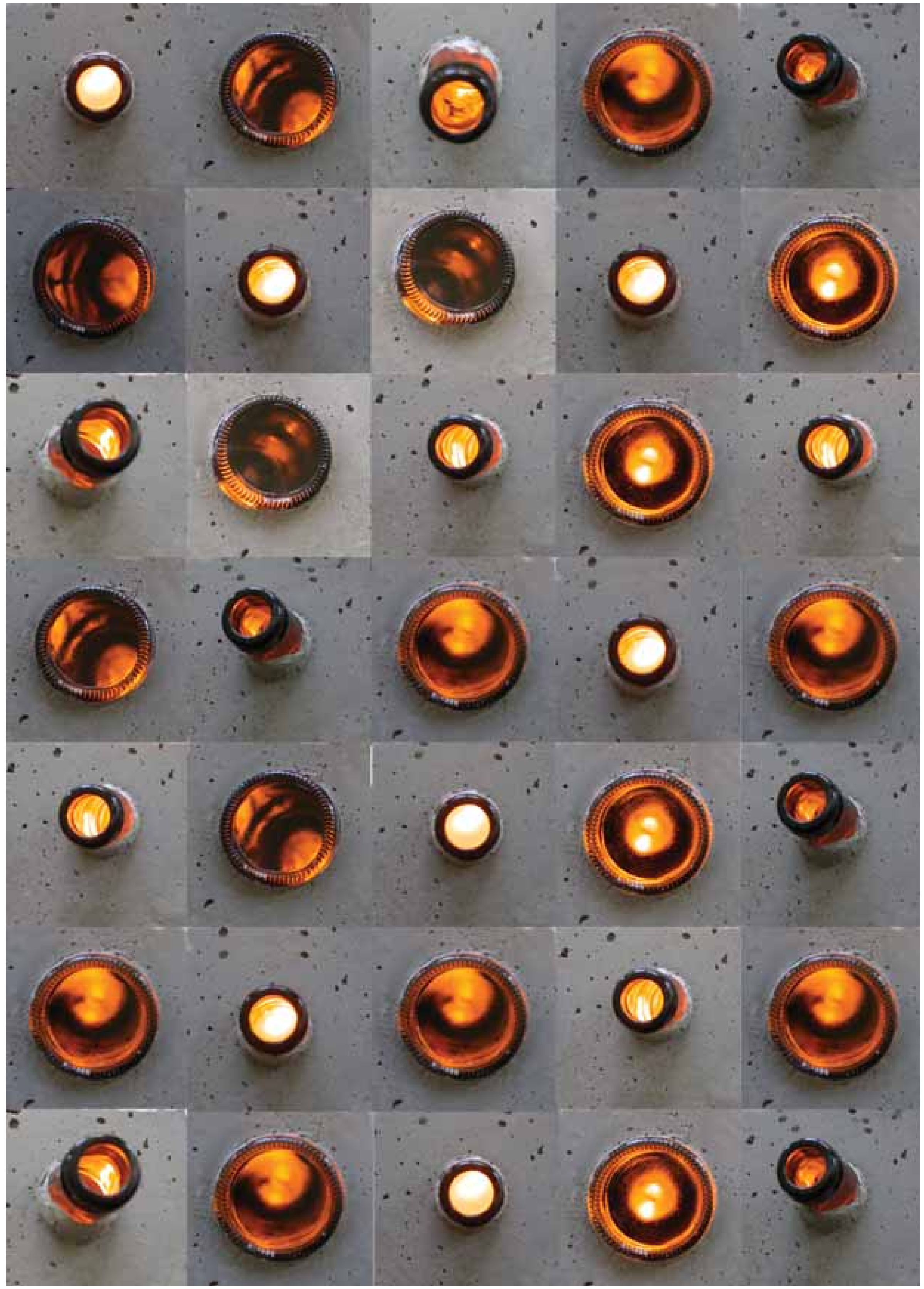
The search for transparency in concrete seems to be culminating in the invention of the glass brick façade. Of course one can discuss whether such a façade is foremost a glass product or a concrete one. Nevertheless the quest for transparency in concrete seems to be continuing. Group1, however, did not investigate the general 'property' of transparency but concentrated on more intricate ways of perforating concrete walls. Proposals ranging from gradually changing formal properties – showing on one side an 'A" and on the other side a 'Z" – to morphing the openings by use of more 'form-rich' elements – glass bottles – show a totally different approach. Transparancy not as a physical property but as an experience.











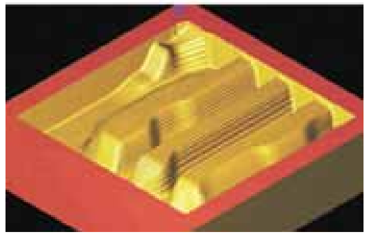
GROUP 2

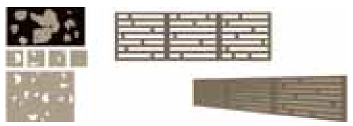
Kristof de Bonte, Sönke Gebken, Afshin Mehin, Basak Ucar, Niels Verkooijen

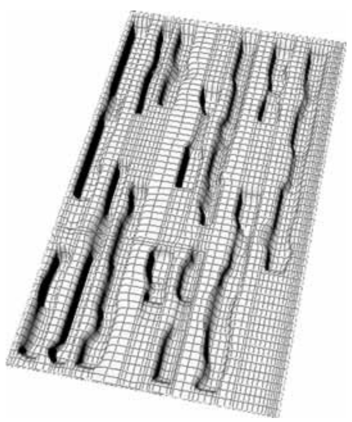
Primitive: windows / columns

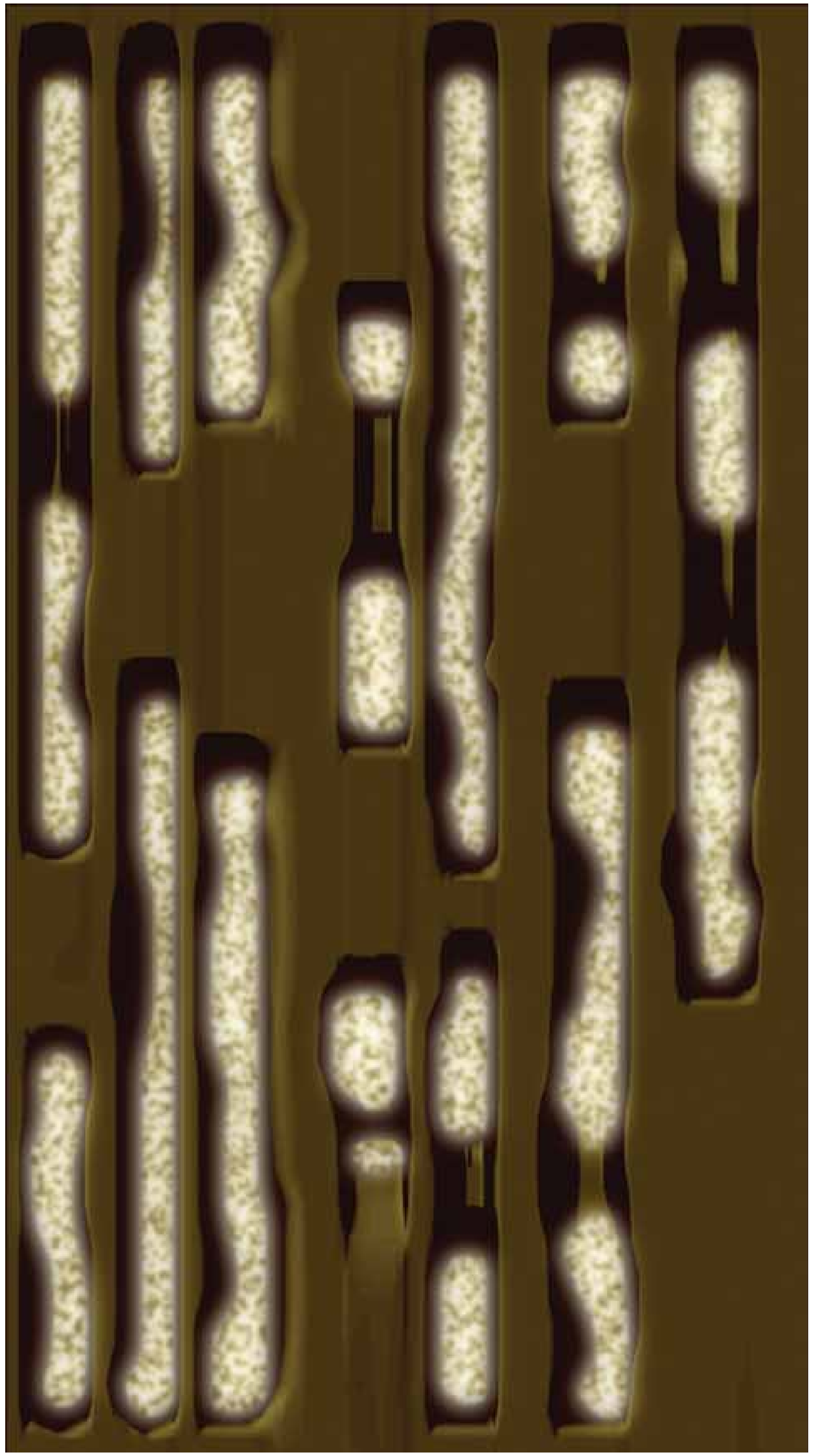
Inspired by light penetrating and being diffused by natural or artificial three dimensional mosaics (e.g. stacked stones, tree leaves, etcetera) group 2 concentrated on a two directional material research. On the one hand experiments were undertaken in which formal aspects were developed. The desired translucent qualities were generated by minimizing the thickness of parts of a panel. Structural demands were met by reinforcing these ultra thin areas with cloth. On the other hand the basic 'building' elements of concrete were driven to their limits in order to achieve a true transparent type of concrete. Smaller aggregates were removed form a standard concrete mixture. While also introducing such a reduction of the amount of cement that the larger aggregates (pebbles) were just covered enough to maintain a minimum of solidity.

(also see cover image)







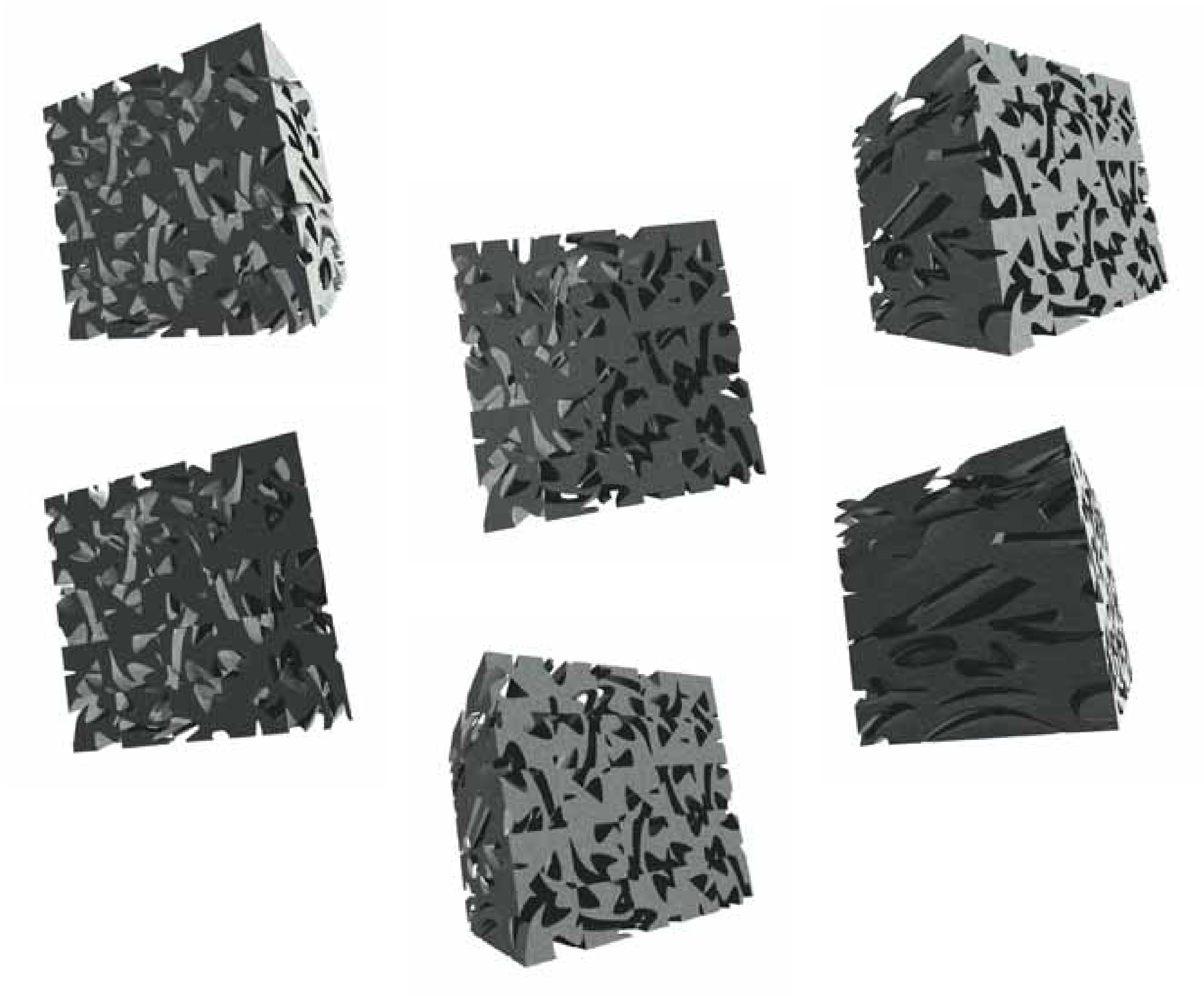


GROUP 3

Tiago Furtado Cabaleira, Christopher Glaister, Tuba Karpuzoglu, Luc Schouten, José Manuel Vacas, Kenny Verbeeck, Daniel Zajsek

Primitive: column / wall / window

Group 3 investigated the changing and classic relations between inside and outside, and vice versa. Creating a theory and conducting experiments to gradually transform a very conventional (rectangular) static space – in which the differences between inside and outside are clearly defined by just as clearly marked out openings – into a dynamic continuous space. Inside becomes outside becomes inside. Borders disappear and the meaning of space becomes as diffused as enticing. The actual endings of an object become truly arbitrary thus generating a 'sponge'. Columns, walls and windows as we know them as related but separate elements become one in terms form, function and structural behavior.



GROUP 4

Levent Firat, John Hutchinson, Sebastian Nagy, Marjeta Zupancic

Primitive: wall / surface

The exploration of pure surface qualities of walls led to the development of a randomized surface structure. New technologies in mould production like CnC-milling opens up possibilities to produce large series of perfectly executed copies of more complex forms than could be achieved up till now. Also it offers the opportunity to maintain the exact formal properties when the model is scaled up or down. This 'knowledge' generated a proposal in which one element in different sizes and positions (horizontal or vertical) can create surfaces that serve totally different needs and create a variety of spatial qualities and atmospheres.









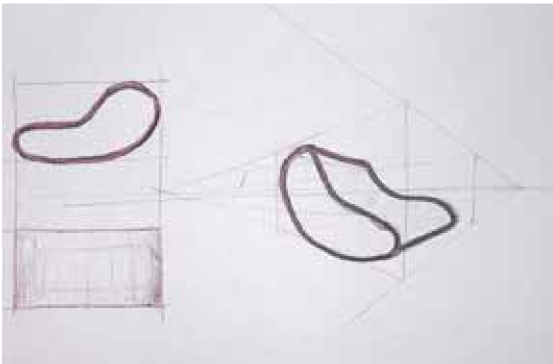


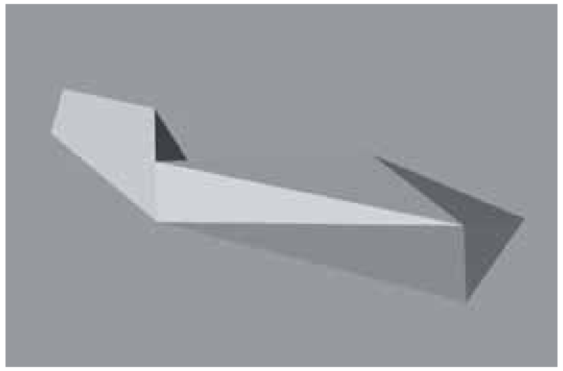

GROUP 5

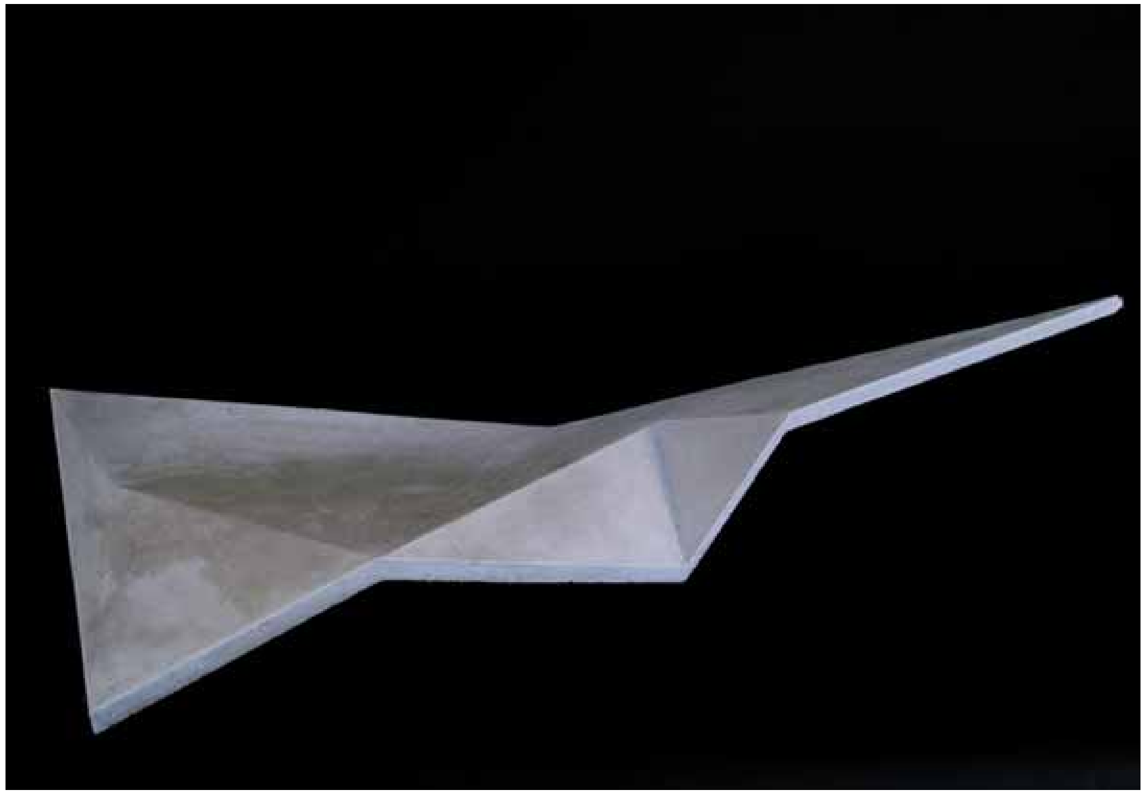
Tom Broes, Emre Çetinel, Thomas Kilvert, Jon Mjönes

Primitive: chairs

'Prototype for a structural surface that encourages individual interpretation and interaction. Designed to be rotated, flipped or tessellated to create a variety of functions / uses whilst being stackable. Milling the formwork from 3 dimensional CAD model enables the scale of the prototype to be easily adjusted.'





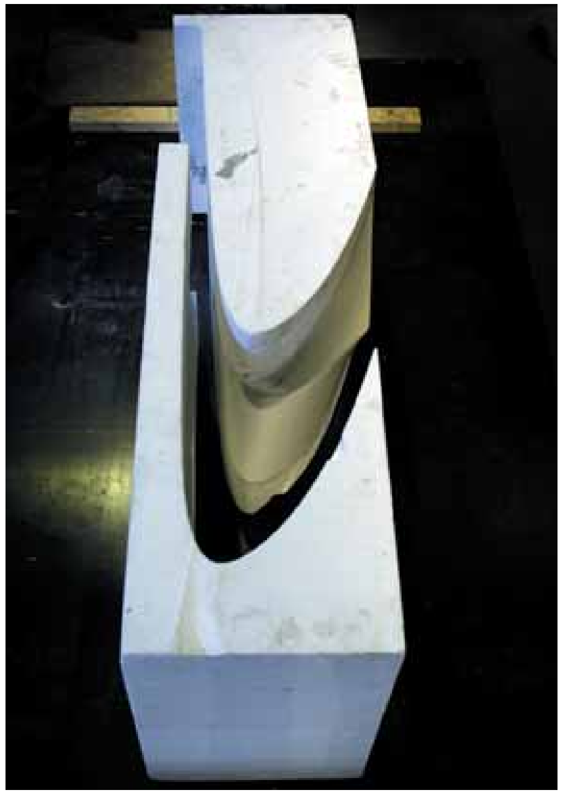


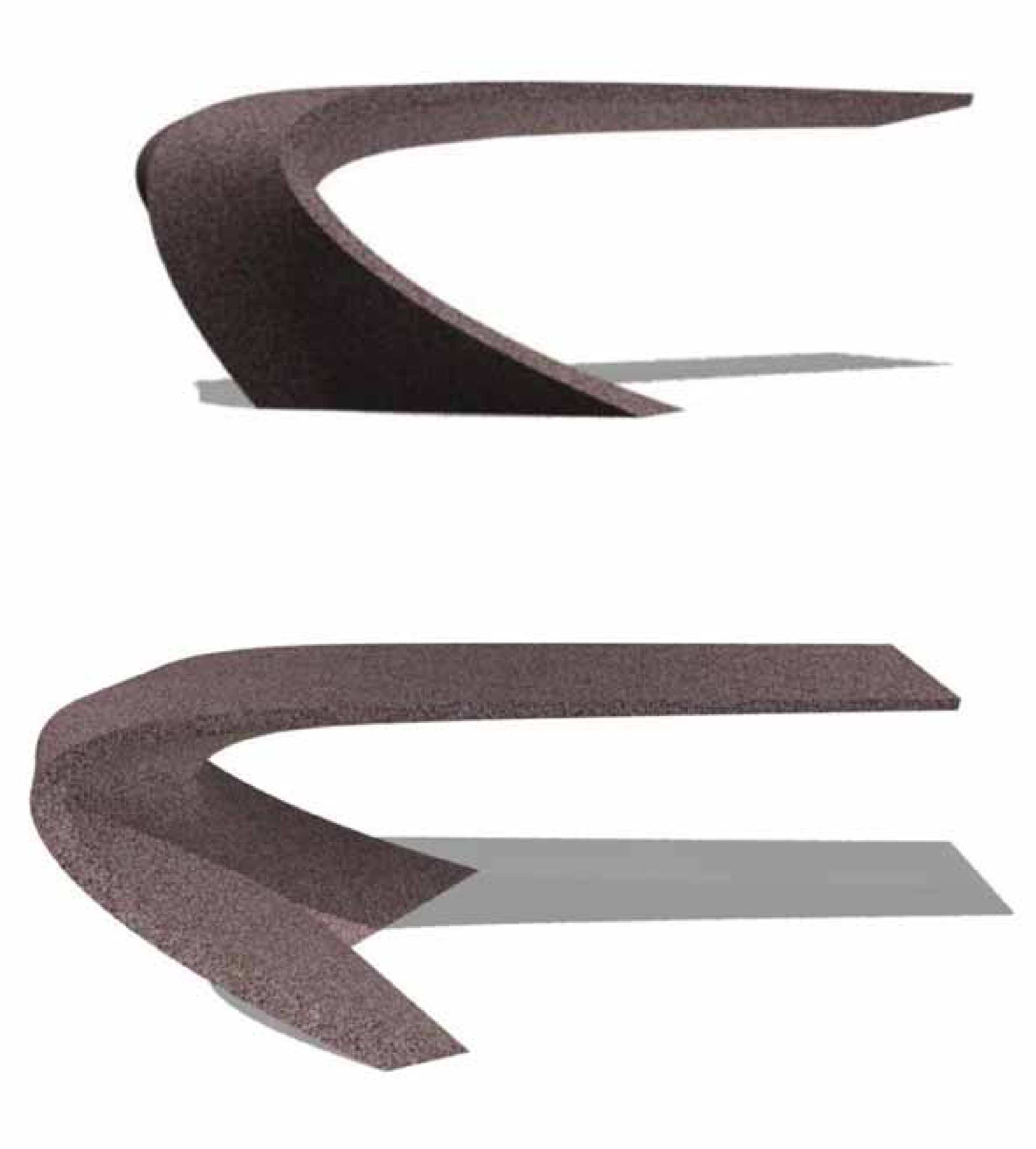
GROUP 6

Güney Cingi, Bas van der Pol, Tomas Rosén, N.Onür Sönmez, Thomas van der Velde

Primitive: coffee table

'Concrete Swoosh consists of two different types of concrete with different physical and aesthetic qualities. An outer skin of glass fibre reinforced high strength concrete that embraces a body of porous lightweight concrete. The result is a structurally and aesthetically challenging synergy which stretches the boundaries of concrete use.'



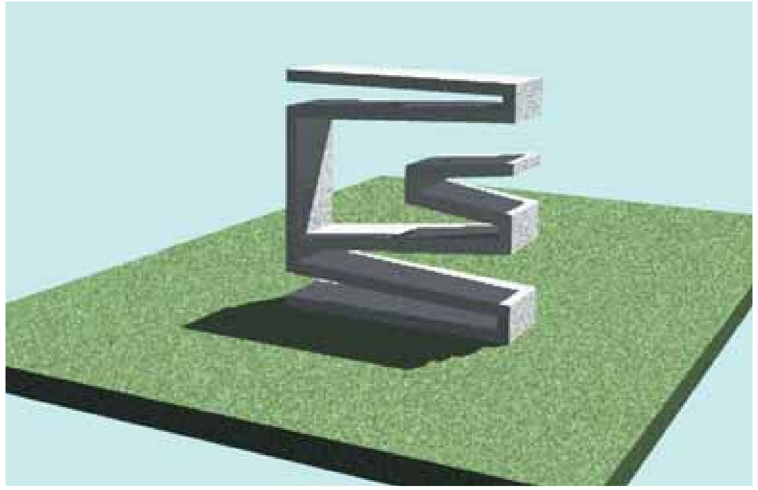


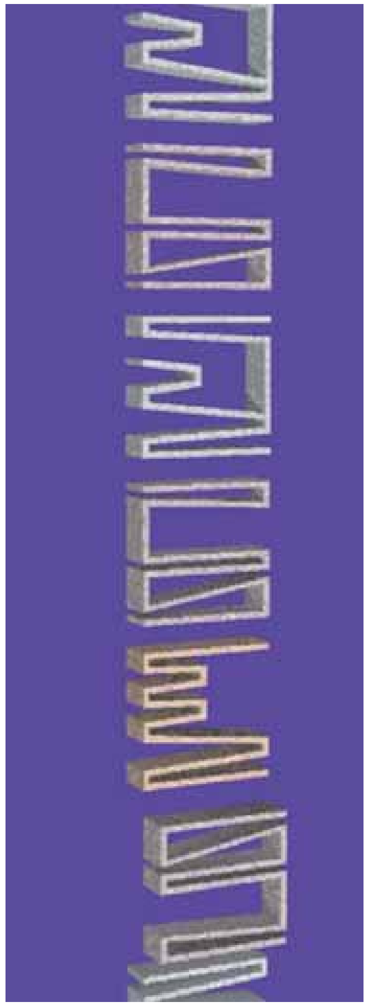
GROUP 7

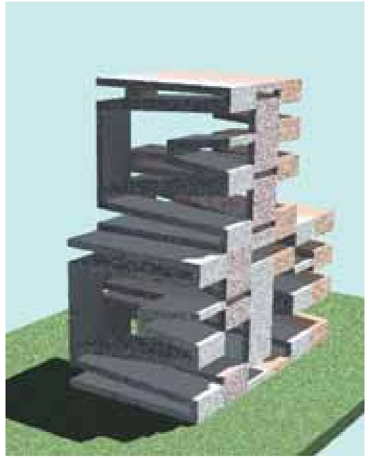
Matthew McCullagh, Simon Cafferty, David Kelly

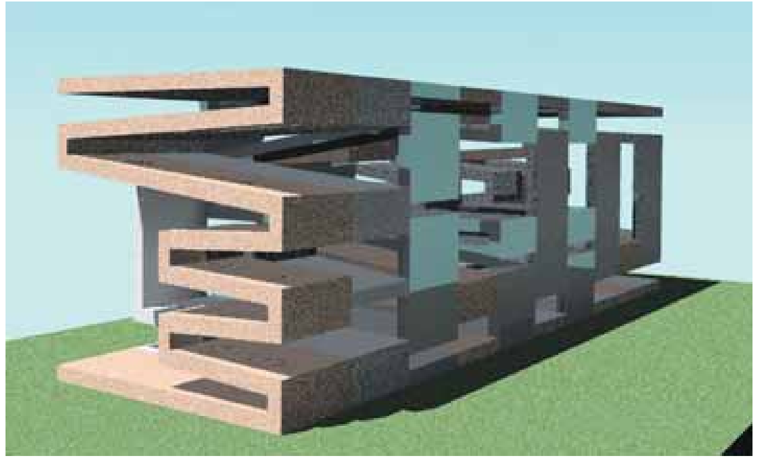
Primitive: glass brick façade

Confronted with the simple 'one dimensional' transparency of a generic glass brick façade forced 'team lere' to radically rethink the properties, qualities and especially the inherent possibilities of such a building element. Identifying the glass brick façade as 'holes' hold together within a regular 'maze' of concrete led them to liberate and utilize this 'maze'. Projected at different scales and in a variety of locations the full impact of the richness of a simple 'exercise' in form, function and structure became obvious. 'Concrete creates the essence of stability while providing a system of transparency through repetitive elements.'









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THE IDEA AND THE PEOPLE BEHIND THE COMPETITION

HANS KÖHNE - ENCI, COORDINATOR

The International Concrete Design Competition for Students was initiated by the cement and concrete industries in the eight participating European countries. From Ireland in the far west to Turkey in the east; from Sweden in the north to Portugal in the south; and taking in Belgium, the Netherlands, Germany, and the United Kingdom.

What motivates us to play an active role in the education of students in the disciplines of design and architecture, apparently so far from our quarries and factories?

We work to enhance the quality of cement and concrete, the basic building materials of the modern world. The strength and durability of concrete are well understood today. Civil engineers have long been comfortable using concrete. Understanding of the behavioural properties of concrete is firmly rooted in their education. And it is still studied in many laboratories. Concrete technology as a science has developed in leaps and bounds and has expanded the horizons of building design. Sophisticated types of concrete – among them high-strength concrete, fibre-reinforced concrete, lightweight concrete and self-compacting concrete – are becoming commonplace throughout Europe. The growth in the range of recycled materials that can be used in concrete is contributing significantly to improving our environment. The link between cement production and concrete as a structural material is certainly well established.

But what of the link between cement production and the use of concrete as an architectural medium? That is a different story. From the very beginning of cement and concrete, architects have been fond of the idea of using liquid stone to create monolithic seamless structures of almost any shape. As a consequence of industrialization in the construction sector, however, the potential was not exploited but restricted. With the use of state-of-the-art techniques, we can now enjoy new possibilities for three-dimensional design and production. We see similar developments in the aesthetics of surface qualities; material research and product development have resulted in unexpected possibilities, in colours, in textures, even in dynamic appearance, that are appreciated by the artistic sensibilities of architects and designers.

Schools of architecture can give a strong impetus to our understanding of concrete as an architectural medium. We – the cement and concrete industries – have been working on improving the links between concrete and architecture nationally. Developing open relations with teachers and students, who have a keen interest in building materials that can contribute to sustainable progress, is a key position in education.

Based on in-depth discussions with educators and students, we are convinced that an international design competition, which focuses on design intelligence with a strong link to material properties, is a good tool to stimulate students to be involved in studying architectural material research and in entering the adventurous world of concrete.

The process of defining a concrete design competition was new for us, new for educators, and new for students. It would not have been possible without the extraordinary co-operation of individual teachers and schools, whose advice on the concept was fundamental and who willingly incorporated the concept into their academic schedules. Nor would it have been possible without the willing support of practising architects and others whose critical comments within the national and international jury has been valuable.

Looking forward to future competition editions, we are sure that the basic concept can expand beyond the eight countries, perhaps to include all European countries. Continuous improvement to the competition concept will further enhance its value for schools and students, as well for industry. The Concrete Design Competition will help us to stimulate a positive attitude towards research into architectural materials. And this is our basic belief: understanding concrete as an architectural medium is not a matter of simply reading books. The material must be explored and exploited. First-hand experience is vital. Thinking comes through doing, and so does learning.

COLOPHON

CURATOR		**Michael Speaks**
Initiative and organisation		
Belgium	Febelcem	Jef Apers
Germany	BDZ	Jörg Fehlhaber
Ireland	Irish Cement	Brendan Lynch
Netherlands	ENCI	Hans Köhne
Portugal	ATIC	Maria Dulce Louçao
Sweden	BetongForum	Öyvind Elseth, Anita Stenler
Turkey	TCMA	Çaglan Becan
United Kingdom	The Concrete Centre	Allan Haines
Consultant	bureaubakker	Siebe Bakker

Very Special Thanks to:
Maria João Anzacot, Colm Bannon, Wim van den Bergh, Marlou Buisman, Guy Châtel, Cheops, Ian Cox, Annette Gigon, Mike Gilbert, Jacqueline Glass, Tania Goutoudis, Mike Guyer, Stephanie Helfferich, Anders Jonsson, Niklaus Kohler, Barbara Leichtle, Wim van Loo, Jean-Françoise de Noëll, Brigitte Pas, Fatima Rato, Marina Scherps, Claus Schiffler, Robin Spence, Stylos, Rosemary Tobutt, Murat Toksös, Fredrik Winberg

Website	De Twee Snoeken	Erik Jens
Graphic Design	De Twee Snoeken	Bart Smit

COMPETITION

NATIONAL JURIES

Belgium: Wim Cuyvers, Maarten Delbeke, Pablo Lhoas, Laurent Ney, Didier Vermeiren
Germany: Klaus Bollinger, Antje Krauter, Christian Schittich, Till Schneider, Volker Staab
Ireland: Gary Lysaght, Tarla MacGabhann, Antoinette O'Neill, Shane O'Toole
Netherlands: Juliette Bekkering, Don Murphy, Joop Paul, Koen van Velsen, René van Zuuk
Portugal: António Adão da Fonseca, João Luis Carrilho da Graça, Michel Toussaint
Sweden: Sven Ahlénius, Sten Forsström, Carl-Eric Hagentoft, Bengt Lindroos, Johan Silfwerbrand
Turkey: Emre Arolat, Nihal Bursa, Boran Ekinci, Abdi Güzer, Ziya Tanali
United Kingdom: Sarah Chaplin, Kathryn Findlay, Stephen Hodder, Hanif Kara

INTERNATIONAL JURY

CURATOR / CHAIRMAN INTERNATIONAL JURY
Michael Speaks
Michael Speaks (Ph.D, Duke University) is an educator, researcher and editor. He is currently Director of the Metropolitan Research and Design Postgraduate Program at the Southern California Institute of Architecture in Los Angeles. Speaks has taught in the graphic design department at Yale School of Art, in the architecture departments at Harvard and Columbia Universities, and has been a researcher on the Architecture Faculty at Delft University of Technology in the Netherlands. Speaks has published and lectured internationally on art, architecture, urban design and scenario planning, and is a contributing editor for Architectural Record as well as an editorial advisory board member of A+U (Tokyo) for which he edits the series 'Design Intelligence'.

GERMANY
Amandus Sattler
Born of 26 March 1957 in Marktredwitz, Germany
Studied architecture at the University of Technology in Munich
Principal of Allmann Sattler Wapner Architekten in Munich

More or Less - Philosophy:
"…building is mostly an understanding of decisions that have been taken elsewhere…" (Rudolf Schwarz)

"Architecture is practice and not discourse… Architecture does not comment on the world. Rather, it influences the world. It generates ideas and effects through the medium of transitory artefacts, while bypassing the established path of theory and practice.." (Stan Allen)

BELGIUM
Paul Robbrecht
Since his graduation as an architect in 1974, Paul Robbrecht has developed, together with his partner and wife Hilde Daem, an outstanding and recognized architectural oeuvre. Their work has been published in numerous architecture magazines and has been the subject of several monographs. With such projects as the Aue Pavilions for Documenta IX, various designs for art galleries, temporary exhibitions and museums, and most recently the extension and reorganization of Boijmans van Beuningen Museum in Rotterdam (1997-2003), the office has produced an important body of work that examines how visual art is housed. With the recent completion of Bruges Concert Hall (1999-2003), the full maturation of an oeuvre initially developed in small-scale but precise and often exemplary design projects has become clear.
Paul Robbrecht has lectured at the Akademie voor Schone Kunsten in Gent and the Architectural Association in London. He also lectures on architectural design at the Hoger Architectuurinstituut St Lucas and is a visiting lecturer at the University of Gent, Department of Architecture and Urban Planning.

NETHERLANDS
Rob Nijsse
Rob Nijsse is Consulting Engineer and Director of ABT, one of the bigger consulting engineering firms in the Netherlands. Dialogue between architecture and structure is a main concern in his work. With a strong involvement as consulting engineer, he contributed to the quality of some well-known projects, among them the Educatorium building (OMA) and Minnaert building (Willem Jan Neutelings) in Utrecht, and the Dutch Pavilion (MVRDV) for the Expo 2000 in Hanover. Besides working with traditional structural materials like concrete, steel and wood, he devotes particular attention to glass and its structural potential.

TURKEY
Selahattin Önür
Selahattin Önür is an architect and Associate Professor at M.E.T.U. Department of Architecture in Ankara. During his long academic career he has been involved in teaching students of all levels mainly at M.E.T.U. Ankara and Yarmouk University in Jordan. Besides his teaching practice he has been involved in many international conferences, workshops and research projects on design issues as well as educational and organizational matters like the EAAE. He is well versed in initiating, hosting and judging many design competitions ranging from architectural design to urban planning.

UNITED KINGDOM
Alan Stanton
Alan Stanton AA Dipl (Hons) M.Arch. RIBA trained at the Architectural Association, London. He was awarded a Fellowship in Urban Design at the University of California, Los Angeles.
Following a period of work with Norman Foster, he worked with Renzo Piano and Richard Rogers on the Centre Pompidou in Paris (1971-1977). Later in private practice, he designed part of the Museum of Science and Industry at La Villette, Paris.
Alan Stanton established the practice Stanton Williams in 1985 with Paul Williams, bringing together their experience working on projects in the UK and around the world. Their shared passion for the arts established the creative direction of the practice and continues to strongly inform their approach to design.
Alan is currently a member of the Design Panel of the Commission for Architecture and the Built Environment, Vice President of the Architectural Association, and a Fellow of the Royal Society of Arts.
Alan has lectured in America, Europe and Britain, and many of his projects have been published extensively in books and journals.

IRELAND
Derek Tynan
Derek Tynan Architects is a design-orientated practice with a reputation for excellence in design and services to its clients, as evidenced by the many awards and commendations received by the practice.
The practice has extensive experience in the design and procurement of buildings, and as an effective design-team leader, in particular on constricted sites and in urban design.

PORTUGAL
Gonçalo Byrne
Born in 1941 and graduated in 1968 from the Escola Superior de Belas Artes in Lisbon, Byrne started his own office in 1975. He has completed projects built in Alcanena, Almada, Arraiolos, Aveiro, Braga, Castro Verde, Coimbra, Funchal (Madeira), Lagos, Lisbon, Oeiras, Setúbal, Tróia, Vidigueira, and Vila do Conde.
From 1985 until 1987 he was director of the Portuguese Architects Journal, and conducted theoretical and critical work. He has published several critical essays in Portugal and abroad.
Byrne has been invited for juries, conferences and seminars in Portugal and abroad, and has exhibited projects in New York, Lisbon, Porto, Lucca, S.Marino, Catania, Milan, Venice, Trevi, Messina (Sicily), Buenos Aires, and Ljubliana.

SWEDEN
Gert Wingårdh
In 1975 Gert Wingårdh became an architect and worked at Olivegrens architectural office in Göteborg and Stockholm. In

1977 he opened his own practice, which has been successful in completing a range of prizewinning projects.
The Chancery of the Royal Swedish Embassy in Washington DC (USA) and the Polar Center, Tjuvholmen in Oslo (Norway), are just two recent works from an impressive list of projects that include private houses, hotels, an air traffic control tower, and large-scale housing schemes. Besides his practical design work he has been chairman of the Swedish Arkitekturmuseum and a member of the Royal Academy of Fine Arts.

NATIONAL WINNERS / PARTICIPANTS MASTER CLASS

Belgium: Kristof de Bonte, Tom Broes, Sebastian Kreusch, Thomas van der Velde, Kenny Verbeeck
Germany: Sönke Gebken, Nils Nolting, Daniel Zajsek, Marjeta Zupancic
Ireland: Simon Cafferty, David Kelly, Matthew McCullagh
Netherlands: Bas van der Pol, Luc Schouten, Niels Verkooijen
Portugal: Luis Pedro Ferraz Marques, Tiago Furtado Cabeleira, José Manuel Vacas
Sweden: Markus Krunegård, Jens Laursen, Jon Mjönes, Sebastian Nagy
Turkey: Emre Çetinel, Güney Cingi, Levent Firat, Tuba Karpuzoglu, N. Onur Sönmez, Onur Sariyildiz, Basak Uçar
United Kingdom: Fransesca Crosby, Christopher Glaister, John Hutchinson, Il Hoon Roh, Thomas Kilvert, Afshin Mehin, Tomas Rosén

MASTER CLASS

Master	Michael Speaks
Tutors	Karl Daubmann, Siebe Bakker
Lecturers	Bernard Cache, Rob Nijsse, Alejandro Zaera Polo
Experts:	Jef Apers (concrete), Klaus Bollinger (engineering), Hans Köhne (concrete), Wim Sambaer (CNC milling / production), Martijn Stellingwerff (CNC Milling / prototypes TU Delft)
Critics	Guy Châtel, Fred Gladdines
Hosts	Berlage Institute / Rob Doctor, Françoise Vos
Support	Joost Bonnema, Okke van den Broek, Matthew Louis Miller, Daniel Roos, Daan Roosegaarde, Maarten Veerman
Prototypes	
Mould production	TwinPlast, Belgium / Wim Sambaer
Prototype seating element:	Hurks Beton, The Netherlands / Ton Fransen
Prototype table	Strängbetong, Sweden
Prototype wall panels	Dahme Baustoff GmbH, Germany

BOOK

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International Concrete Design Competition for Students 2003/2004 – ROBUSTNESS

'... there are qualities associated with ROBUSTNESS, such as strength and solidity, which are also the qualities of concrete. Used to lay foundations, to build sturdy bridges and muscular, architectural monuments, concrete, even in its most conventional use, is an undeniably robust material. There are other qualities associated with ROBUSTNESS, however, not conventionally associated with the sturdiness of concrete. Due to the growing importance of complex, adaptive behaviour in all areas of scientific enquiry, ROBUSTNESS has also come to define the degree to which living things, whether single cell organisms, flocks of migratory birds, or complex social systems like ant colonies or metropolises like Tokyo or Mexico City, adapt to changing environmental conditions and evolve over time. ROBUSTNESS, in these contexts, defines a new kind of strength and solidity based on flexibility rather than inflexibility, on suppleness rather than stiffness, on resilience rather than rigidity...'

Michael Speaks, curator

'From the very beginning of cement and concrete, architects have been fond of the idea of using liquid stone to create monolithic seamless structures of almost any shape. As a consequence of industrialization in the construction sector, however, the potential was not exploited but restricted. With the use of state-of-the-art techniques, we can now enjoy new possibilities for three-dimensional design and production. We see similar developments in the aesthetics of surface qualities; material research and product development have resulted in unexpected possibilities, in colours, in textures, even in dynamic appearance, that are appreciated by the artistic sensibilities of architects and designers.
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Hans Köhne, coordinator

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