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How heavy is a brick, how rough is it? What are the basic properties of a processed piece of clay, mixed with sand and other substances? These were the fundamental questions occupying 36 students and teachers from seven European universities during a ten-day workshop at a brick factory in the Dutch countryside.

Landscape of forgotten techniques

Over the course of three years, the workshop series entitled 'Building Anatomy' followed a path of materials that wound through a landscape of forgotten techniques and left its traces throughout Europe. Built within a few days in an intensive program, a rope bridge[1] in a Slovenia still allows hikers to cross a steep valley; a series of Catalan vaults[2] still casts shadows on a schoolyard near Barcelona and a wooden longhouse[3] on a Norwegian Island still shelters people's belongings during winter and serves as a market stand in summer.

Stacking things

In contrast, the Amsterdam Academy's last series of workshops concentrated on using one type of material in order to open up a broad range of sculptural and spatial possibilities through experimentation. The tectonics of used fruit crates, the architectural potential of a huge amount of thin wooden slats or even working in an abandoned greenhouse and on the beach (both prototypical environments within the manmade landscape in the Netherlands) led to unpredictable results that were strongly based on the design-by-building method.

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Echoes in brick

This year's workshop merged these two approaches and opened a new field of research in which tectonic aspects of building were materialised in brick. To learn from working with bricks meant peeling off the skin of assumed knowledge about a well-known material. The process of reflecting while working allowed people to discover the properties of the material and find the proper building techniques in a process of repeated steps. Without using any tools or mortar, a specific artisanship had to be built up. Gravity and adhesion were the only guarantees that structures would hold. Thinking about a material in such a direct and physical way not only stimulated an immediate learning process but also motivated the stacking during this period of almost two weeks. At the very end of the workshop, all of the bricks were stacked back onto the palettes where they had previously been piled, concluding an intensive experience that blurred the line between building and architecture.

Urs Meister
Professor of Construction and Design, Institute for Architecture and Planning, University of Liechtenstein

The work was supported by the European Community, especially the National Agency of Liechtenstein, the involved universities, and the Den Daas brick factory, which provided the site and materials.

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An exacting Material. Notes on the Stacking of Bricks.

1.
In the door at one end of the kiln is a little inspection window. At the back, looking past the edges of the kiln wagons, you can see the blinding white light of the fire. Over eleven hundred degrees – audible, almost palpable. In the control room, above the kiln, a graph hangs on the wall: time runs horizontally, temperature vertically. A brick stays in the kiln for three days. The temperature rises fitfully and goes back down again, peaking and plunging. Adding air causes the temperature to go up; closing off the air supply causes the oxygen in the clay to burn. A careful horizontal line on the graph marks the quartz transition temperature as clay irrevocably turns into brick. While heating up is simple, cooling off is more difficult. The more gradually it is cooled, the better the brick. For each sort of brick there is a different graph, its own orchestration of fire and air.

Mounds of different clays lie in the factory depot. The colour of the clay says nothing about the colour of the brick that is made from it. Every kind of clay has its own character: fine clay that is deposited by the wind, coarse clay that is deposited by the water, ocean clay and river clay, the geology of landscape as the basis for a brick.

Brick has an elemental nature; it transcends cultures and eras. It is a building material made of earth, water, fire and air. Change one of these and you get a completely different brick.

2.
The size of a brick is such that you can pick it up with one hand and lay it in its place. Through that physical action, a wall is made. A brick is the smallest unit with which you can create architecture. No matter what the magnitude of a wall, you can still recognize the physical act of stacking. You can see the artisanship of its maker. Stacking is the discovery of a relationship. Format, differences in the size of the bricks and the way tolerance is handled are important here. The relationship yields a texture that is established in the module of a few bricks. To assess this texture, you must stack. To see its richness, you must take a distance and

walk around it. One’s experience of texture is inseparably connected with movement, with changes in the light, with differences in light in the morning, afternoon and evening. A good stacking expresses the richness of brick: variations in sheen, nuances of colour, the difference between the sides of a brick.

Mistakes inevitably creep into the stacking and the repetition of patterns. New textures arise from these flaws. The question of the corner, how you take a bonding around a corner, also often produces a new texture. Sometimes intentional, other times unintentional: the evolution of a bonding and a texture. Brick is an exacting material. You cannot simply do everything with it, for mistakes are immediately visible. If you think and work with the material, with the possibilities it offers, you come up with ideas and solutions that cannot be designed in advance. If you force an idea onto the material, it becomes unmanageable and does not work with you. Whether a stacking or a bonding is beautiful is something you do not actually know ahead of time. By repeatedly stacking anew, you learn to think with the material. You develop insights into the possibilities of brick and develop an intuition for the richness of the final image.

3.
The stacking of bricks is a game you play with gravity, with the wind and the balance of the stacking. If you break the rules, the wall will topple. Every stacking has a beginning and an end, from the bricks at the very bottom, which must bear the full weight of the wall and also follow the topography of the ground, to the bricks at the very top, which lean against nothing but air and fall the most easily. The stability of a wall is contained in the stacking relationship and the form of the wall. With stacking, you are inevitably confronted with the Vitruvian Triad *firmitas, utilitas et venustas.* The role of brick in this triad is ambivalent. In today's building practice, façade brickwork seldom has a supporting function anymore. Brickwork is cladding, and on a cavity wall it works well and is long-lasting. In the sense of ‘utilitas’ it is (still) a relevant building material. In a building where the supporting structure and the outer wall are separate, the

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1 **Church Benedictine abbey Vaals, Dom Hans van der Laan**
2 **Paviljoen Insel Hombroich, Erwin Heerich**
3 **Haus Lange, Krefeld, Ludwig Mies van der Rohe**
4 **Kolumba Museum, Köln, Peter Zumthor**

5 **Pavilion Park de Hoge Veluwe, Otterloo, MVRDV**
6 **Pavilion Kroller Muller Museum, Otterloo, Gerrit Rietveld**
7 **Het Schip, Spaarndammerbuurt, Amsterdam, Michiel de Klerk**
8 **Pavilion Insel Hombroich, Erwin Heerich**

brickwork façade can still express the ‘firmitas’ of the building. But in essence, this is an architectural choice rooted in ‘venustas’. As far as the tectonic expression of a building is concerned, ‘firmitus’ is thus a special category of ‘venustas’. And as far as the stacking of the bricks that comprise the façade is concerned, ‘firmitas’ is still always ‘firmitas’. The walls that fell over during the workshop proved this time and again. In a brick wall or façade, ‘firmitas’ and ‘venustas’ keep switching roles. Dealing with this ambivalence makes the designing of brickwork façades a special architectural assignment. If both the ‘venustas’ and the ‘firmitas’ converge in the design of a façade or wall, a fascinating image arises that can continually be read in different ways. If they do not converge, auxiliary constructions, expansion joints and dilatations ultimately determine the image. Brickwork is then simply wallpaper, mindlessly applied.

4.
Brickwork displays a variety of appearances. From a certain distance, the abstract image is determined by its ceramic quality (matte or glossy) and basic colour, which often is the shard of the brick. As you gradually approach, the image is determined by how the ambivalence between ‘firmitas’ and ‘venustas’ is dealt with – the tectonic assignment – the texture of the stacking, exceptions in the relationship, the details around openings, the corners, the eaves and the plinth courses. Close-up, the details become visible. Now the bonding, the joints and the type of brick determine the image. Extrusion, water-struck, machine-moulded or hand-molded bricks. From incredibly hard to almost fragile. The origin, the firing of the bricks is expressed; subtleties of colour, sintering, reduction, sanding. When choosing brick for a building, you must look at the design from various distances and approach it in various ways: from far off to close by, and from sidelong to frontal views. The nature of a brick building unfolds as you come closer, always providing a new experience that is determined by the light and your proximity to the building. It is not until the spectator moves that the building truly reveals itself.

5.
Brick is a fascinating and very gratifying material. But this workshop is not about the specific knowledge of brick; it is about an attitude, a way of working and thinking. The first exercise, stacking a pallet of bricks over and over again in the storage area, is about playful discovery, without any predetermined ideas about an ultimate goal or image. Discovering the logic of a material and how to work with it. Starting with playful stacking and working toward objects, sometimes digressing in order to discover new things. The value of the detour.

The second exercise, the stacking of an object out of five pallets of bricks in the clay depot, is actually a traditional assignment, although it lacks a concrete program or goal. The starting points for this stacking are the site, the choice of brick and a preconceived idea about the object to be made. Playing, or trying out, is still part of the process, but the central focus is to make an object that fulfils the original plan – to make a modest statement. Here we resume speaking in terms of concepts and ideas.

In the end, the projects arise from two opposite directions of thought. One direction involves the materialization of an idea or concept about a particular site, perhaps even with a function or goal. The other concerns the conceptualization of a material, the eliciting of insights and ideas and reflecting on the directly experienceable physical qualities of a material. Both approaches are relevant and valuable. The workshop looks for what they have in common, where they converge and enrich each other to produce a special way of working.

Machiel Spaan
Jan Peter Wingender

To be honest, I was a little bit sceptical the first time I heard about the workshop experiments. The first part of the experiment consisted of stacking ceramic bricks in the storage area of a brick factory. The two basic architectural issues one had to deal with were place and planning. The location was sterile and the programme unclear.

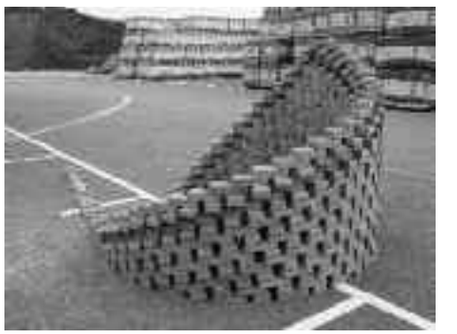
The game started with a very simple rule: stacking bricks. Every group had a different type of brick with specific characteristics: format, density, strength, texture and colour. These differences were big, and made the game richer than I had expected.

As Dr Albert Cuchi[1] wrote in his article in *DAU*[2] magazine, 'piling up is a game with truthful rules because they are based on physical laws: gravity dominion. If these rules are not followed, the wall will fall down. The worker takes a brick and puts it over the previous one in order to build the wall. There is only one condition that has to be fulfilled: the stone has to remain still afterwards. Every new stone subjects the previous one to a new balance of forces, a new and as yet unproved state of equilibrium; therefore, as the wall is built up, the stability of every brick faces a new danger situation, as does the whole structure.'

It is well known that the stability of a brick wall is obtained through the fulfilment of specific rules: if there is any continuous joint it must be perpendicular to load directions; meanwhile, for the rest of the joints, the wavier they are, the better. Finally, the recommendation is to keep the bricks whole; in our case, this was a basic condition for the prevention of accidents.

The obtained results challenge all these laws. The stability of the whole was carried to the limits of possibility in an attempt to get the most expressiveness out of the material. The balance between stability and expression was taken as far as it could go.

The main goal of this first experiment was to discover a 'system' – a theoretical model that fixes rules of internal performance. Once such a system has been found, there



1
Albert Cuchí Burgos. Professor in the Department of Architectonic Construction, Universitat Politècnica de Catalunya (UPC).

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AAVV. Review DAU nº 24 (2005): *Apilar versus trenar. Apilar,* (pg13–20). Col.legi d'Arquitectes de Catalunya (COAC), demarcació de Lleida (2005)

is only one thing left to do: test the variability, mobility, versatility of the system in order to build the object.

When it comes down to it, such systems are formulas for addition: that is to say, basic models for adding bricks. The repetition of these basic models leads to a superior entity. For each type of brick in the experiment, the best way has been found to combine it so as to show its physical characteristics.

Sometimes the basic unit is stable in itself. Sometimes, stability is achieved by the whole construction. And in other cases, more stability is revealed at different scales; that is, the unit is stable by itself, but multiplications of this unit lead to geometries that give more stability to the construction. These geometries could also be obtained by becoming more winding and wider, but the basic unit is still a three-dimensional addition formula.

Finally, one must mention a type of wall in which there isn't an adding system like the ones mentioned above: layers of bricks that make the wall stable, but don't follow any pattern either. We can say that this kind of construction is more reminiscent of a way of weaving than a way of pilling up.

My initial fear was absolutely baseless, because the repetition of the same experiment made the solutions more sophisticated and more optimized, and therefore success was inevitable. The combination of two simple variables applied to the classic apprenticeship system of trial and error makes the solution almost perfect: getting the maximum expression of the brick and stability of the whole.

But the result is not as important as the learning process that has enriched us – this was the real achievement.

Raimon Farré

For the second part of the workshop, we built upon the knowledge gained with the bricks and expanded and refined these experiences by relating them to a specific site and further developing individual tectonics and texture. As the first step, the five teams, each comprised of five students, selected the type of brick they desired from the various bricks available, basing their choice on form, surface and colour. Next, the students chose a suitable site, focusing on the different heights and colours of the mounds of clay and sand. The students then began to transform the five pallets of bricks into site-specific architectural objects.

For three days, the students experimented at one edge of the factory site where mounds of clay were surrounded by a network of transportation routes, emphasizing issues of tectonics, topography, location, texture, light, shadow, colour, and construction processes. Over the course of these three days, the five brick objects were constantly rebuilt, refined, enlarged and thereby transformed. This allowed the testing of ideas in order to develop objects and gain actual experience – *Baukunst* in brick.

Site
The choice of sites and the implementation and positioning of the brick objects temporarily changed the working routine and characteristic look of the factory. The resultant objects were vital, varied and exciting. With the *Two Walls* project, the construction of two slightly offset walls interrupted the transportation route between the clay storage yard and the factory. This brick object interrupted the natural flow of the factory vehicles and functioned as a doorway through which one could access the new space created by the two walls. The *Carpet* project connected two mounds of clay with the transport route running between them, making them into a whole by the way in which the walls ran alongside each other, following the natural topography of the site. This new space, like a carpet in the landscape, traced the existing surface of the mound of clay and focused attention on two mounds in the adjoining field. The *Canyon* project dug into the ridge of a clay mound, thereby creating a connection between the areas in front of and behind the mound. After the removal of the brick object, the dug-in bricks left a clear imprint in the ridge. This was the only brick object to leave a trace of itself on the factory site.

Tectonics
By putting together individual bricks to create an ensemble, the *Flying Bricks* group experimented with the extent to which the individual bricks could be thrown. The first student in the human chain picked up a brick and threw it to the next student, who threw it to the next, and so on, until the last link in the chain laid the brick on the new brick wall. The creation process thereby followed a regular rhythm. A rapidly growing brick wall was created, whose dynamic production provided a great deal of fun and interesting visual experiences. The brick object of the *Columns* group was made of several individual columns, built with a simple and classic stretcher course. Through the individual columns' interaction and their varied colours, this group emphasized the tectonics of the object as a whole. In order to achieve this, each brick was checked for colour and then assigned to a column. This resulted in a colourful and self-contained arrangement of columns reminiscent of Per Kirkeby's sculptures. The tectonics of a pair of walls played an important role in the creation of *Two Walls*. The most varied combinations were initially tried out in small units and then incorporated into the two walls. This allowed for continuous refinement of the tectonics and for experimentation with the transition between wall and clay mound. The results were two multi-layered brick walls.

Texture
The object entitled *Carpet* made use of the material properties of bricks, with a horizontal part and a fluid, vertical part. The fluid part along the clay mound was created by making the bricks overhang, which could thus also be used as steps. The resulting pattern of joints gave a lively impression, similar to the church cladding by Josef Pecnik in Prague. In a different approach, the striking texture of *Flying Brick* was created by the combination of individual bricks. The interaction between 'open' and 'closed' created a spatial pattern that received additional depth from the tactile qualities of each brick. In yet another approach, the texture of the two brick walls of the Two Walls object

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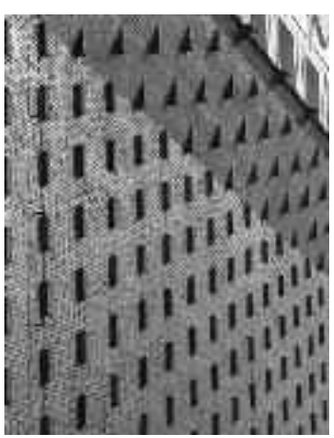

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1 Per Kirkeby, Nora Älvstranden 1992
2 Oriental Detail
3 Josef Plecnik, Church in Prague 1928–1931
4 Temporary pattern in the Canyon project
5 Play of Light and Shadows in the Flying Wall project

drew its character from the lively joint structure. The joints, some at sitting and some at standing eye-level, opened to the top or to the side and closed again. This made one wall appear moretransparent and light, and the other more closed and opaque. The contrast between closed and open was enhanced by the choice of the bricks, reminiscent of oriental windows. This aspect was also based on the hidden interior space created by the two walls. The texture of the Columns object was created by colour and surface alone. Here, the simple stretcher course emphasized the porosity and surface properties of the individual columns and allowed the columns to form a strong ensemble. With Canyon, the texture was created by movement and time. The work was based on the clay ridge and the brick, concluding with a step-like connection through the clay ridge. The horizontal and vertical organization of the bricks created a path, a line and then, after the removal of the object, a temporary imprint and pattern – another kind of brick texture.

Light and Shadow
The self-contained project *Columns* used the play of light and shadow to attain a constantly changing vitality. Depending on the sun, the shadows would fall on the columns or create their own structure on the ground and between the columns. This play of light and shadow combined with colour and spacing to further develop the pattern of the columns, creating a powerful interaction between light, shadow, colour and space. *Flying Wall's* play with light and shadow emphasized the fluidity and lively depth of the wall. The resultant light patterns, reflected on the wall and ground as squared areas of light that are dependent on the tectonics and texture of the wall, further emphasized the complexity and colour of the object. The same applied to the brick object *Two Walls.* The combination of its tectonics and texture created a very lively and beautiful pattern of shadow on the ground.

Re-Stacking
Finally, after all five brick objects had been constantly refined, enhanced and rebuilt over the three days, brick after brick was removed and restacked on the pallets. This demonstrated the extent to which the students had become skilled in handling bricks.

'Tectonics in Building Culture: Brickwork' was a workshop that offered a wide range of vital impressions and lasting experiences. The rapid experimentation and play with the bricks, in combination with visits to selected brick buildings, provided the students with another approach to brick as a construction material. All participants had unconventional experiences and gained invaluable impressions that will allow them to relate their insights to architecture, hopefully leading to new perspectives, novel methods of utilization and the renewal of brick as an architectural material.

Carmen Rist

Tectonics in Building Culture: Brickwork

August 16 – 27 2008

Saturday 16–08
Introduction of the workshop at the Amsterdam Academy of Architecture.

Sunday 17–08
Morning: Field trip to Krefeld; Haus Esters, Haus Lange
Afternoon: Field trip to Museum Insel Hombroich, Germany
Evening: Introduction 1st workshop, Group division.

Monday 18–08
Morning: 1st experiment on the 'tasveld':
Assign locations and type of bricks to the groups on the 'tasveld'
Re-stacking the bricks from the pallet
Lunch: Presentation 1st experiment.
Afternoon: 2nd stacking experiment on the 'tasveld'
Evening Presentation 2nd experiment

Tuesday 19–08
Morning: Tour Den Daas Brick Factory, making a personal brick.
Afternoon: 3rd stacking experiment on the 'tasveld'
Evening: Presentation 3rd experiment

Wednesday 20–08
Morning: 4th experiment on the 'tasveld', photo documentation by Jeroen Musch
Afternoon: Presentation and evaluation of the first workshop
Evening: Walking along the final projects, cleaning of the material
The famous Den Daas BBQ

Thursday 21–08
All day: fieldtrip Germany
Vaals, Abbey Dom Hans Van Der Laan
Düren: St. Anna, Rudolf Schwarz
Cologne: Museum Kolumba, Peter Zumthor
Essen: Zegge Zolverein

Friday 22–08
All day: Fieldtrip to Amsterdam
Historic city examples
Beurs van Berlage en Amsterdam Central Station
Berlage extension (plan zuid)
Eastern harbour area and IJburg

Saturday 23–08
All day: Fieldtrip Eastern part of the Netherlands
Berlage Jachtslot St. Hubertushof
Museum Kroller Muller, Van Eyck and Rietveld pavilions
Evening: Introduction of the second workshop
Lecture by Bruno Doedens

Sunday 24–08
Morning: Construction at the clay depot
Selection of the site and the bricks
Developing design proposal
Lunch: Presentation of design proposals on site of the clay depot.
Afternoon: Construction work on site
Evening: Presentation of site work

Monday 25–08
Morning: Construction at the clay depot
Afternoon: Construction at the clay depot
Evening: Presentation of site work
Lecture by Hans van der Heijden

Tuesday 26–08
Morning: Final phase of construction work at the clay depot
Documentation Jeroen Musch Photography
Aftenoon: Walking along the final projects, presenation of work on site
Cleaning of the all the material at the clay depot
Evening: Big party

Wednesday 27–08
Morning: Return to Amsterdam

Erasmus Intensive Program 2008
Coordination, organisation and tutors

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Tectonics in Building Culture: Brickwork

Edited by: Machiel Spaan & Jan Peter Wingender
Photography: Jeroen Musch (endpapers, p.17–48),
Machiel Spaan, Jan Peter Wingender, Raimon Farré
and Carmen Rist
Translation: Jane Bemont
Design: studio Joost Grootens / Joost Grootens
with Tine van Wel
Printing: Lecturis

This workshop was funded by the EU Community

Academie van Bouwkunst
Amsterdamse Hogeschool voor de Kunsten

HOCHSCHULE LIECHTENSTEIN

daas baksteen walls of fame

Wingender Hovenier Architecten