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Powerlines

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Abstract

As from the decision the authors took to embark on a new enterprise that we described as the fusion of art and architecture on a digital platform, we realized a series of innovative projects at various scales, which are living proof of the chosen fusion concept, along the way showing the progress of our efforts and insights how to implement actual digital technologies in the very design process. In this essay we describe their most relevant and iconic features. The ambition to fuse art and architecture on digital platform has been a radical attitude from the beginning, and we have lived up to this initial ambition until today, having realized a number of public works of art and some larger building complexes as well. We tend not to categorize our built constructs as either art or architecture, we rather consider them to be sculpture buildings or building sculptures. As from the start of each project the artistic dimension has been leading, while the technological novelties were invented along the way with the sole purpose to realize our vision. Typically we invent for each project a new procedure, a new technology, a new way of connecting the vision to the real world. We challenged ourselves to be visionary and practical at the same time. We managed to link our intuition to logic, to train our intuition as to steer our logic. We theorized and practiced signature Powerlines to give shape to the swarming point cloud of reference points, which forms the basis for all further design and execution decisions. The Powerlines are seen as intuitive top down decisions imposed on otherwise bottom-up open design systems.

Keywords

Art; Architecture; Fusion; Digital; Radical; Sculpture buildings; Building sculptures; Visionary; Practical; Intuition; Logic; Powerlines; Swarm; Point cloud; Reference points; Top-down; Bottom-up; Open design systems.

Note

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Vectorial Body

The commissions we have received in the early years of our joint art-architecture practice were to a large extent initiated by the art sector. In the first year of our joint practice, the request to organize a symposium, exhibition and workshops, entitled *The Synthetic Dimension* [1991], which took place in Gerrit Rietveld's cute pavilion *De Zonnehof* in Amersfoort, came from Paul Coumans, art director of *De Zonnehof* and Head of the local art council. One year later, the invitation to join a competition for the *Garbage Transfer Station Elhorst/Vloedbelt* in Zenderen [completed 1993] came directly from Rudolf Krudop, the curator of a regional art council. According to the competition's terms, the new building should fit in a master plan designed by Ashok Bhalotra, who supported Krudop's choice to invite ONL. Mr Krudop became familiar with our work during a lecture by Oosterhuis in Amsterdam, in 1993, at a symposium titled *The Power of Now*, where the legendary Lebbeus Woods was the invited keynote speaker. The art sector has always seen the relevance of the fusion of art and architecture on a digital platform. Maybe that is comprehensible as well, since art has typically been subordinated to architecture, while 'old school architects' would claim architecture to be the 'Mother of Arts'.

We take a different point of view. We stated that art and architecture could only successfully fuse when artists and architects would operate on the same scale and would consider the same budget in their initial design concepts. This implies, especially from the architects' part, an open mind with respect to non-functional input in the design process. The architect must accept the absurd, the alien, the intuitive as a main driver for the design. On the other hand, the artist must accept the fact that the design concept should embody spaces that can be used according to some preconceived idea, often described in a program of demands. However, neither the architect nor the artist should interpret the program of demands in a spatial sense but rather as a description of activities without any spatial preconceptions. Exactly this point turns out to be the most challenging aspect of the fusion of disciplines. The moment that one draws the program as a rectangular shape, or in any other shape, one has chosen a design concept, most likely without even realizing it. It will be extremely hard to get rid of that unconsciously shaped interpretation of the program. Before one realizes it, the diagrammatic content becomes a floor plan, and before one realizes it, the walls are erected upright and they become the shape of the space. The fusion of art and architecture must overcome this trap.

What we presented during that lecture was an animation of an oval shaped building body with an internal intuitive 3d sketch. While the ellipsoid shape is geometrically well defined, the freeform 3d computer sketch is devoid of any meaning, just communicating the thrill of a complex entanglement in space. We presented the animation as an abstract design concept; there was no program, no function, just a spatial challenge in virtual reality. After the lecture, Mr Krudop, Director of the Cultural Council of Overijssel [Culturele Raad Overijssel], invited us to take part in the competition, which we eventually won because our abstract design concept resonated exactly with his ambition to see the building for sorting out garbage in a different way. In his imagination, he already saw a well-functioning building as a large, stretched ellipsoid with alien content, while we had no program in mind when designing. It was our intuition to make that animation such as to trigger the imagination of someone whom we did not know.

The competition design, and subsequently the realized design, were largely a continuation of the abstract animation. The 3d gesture of the sketch basically re-appeared as the movements of the big

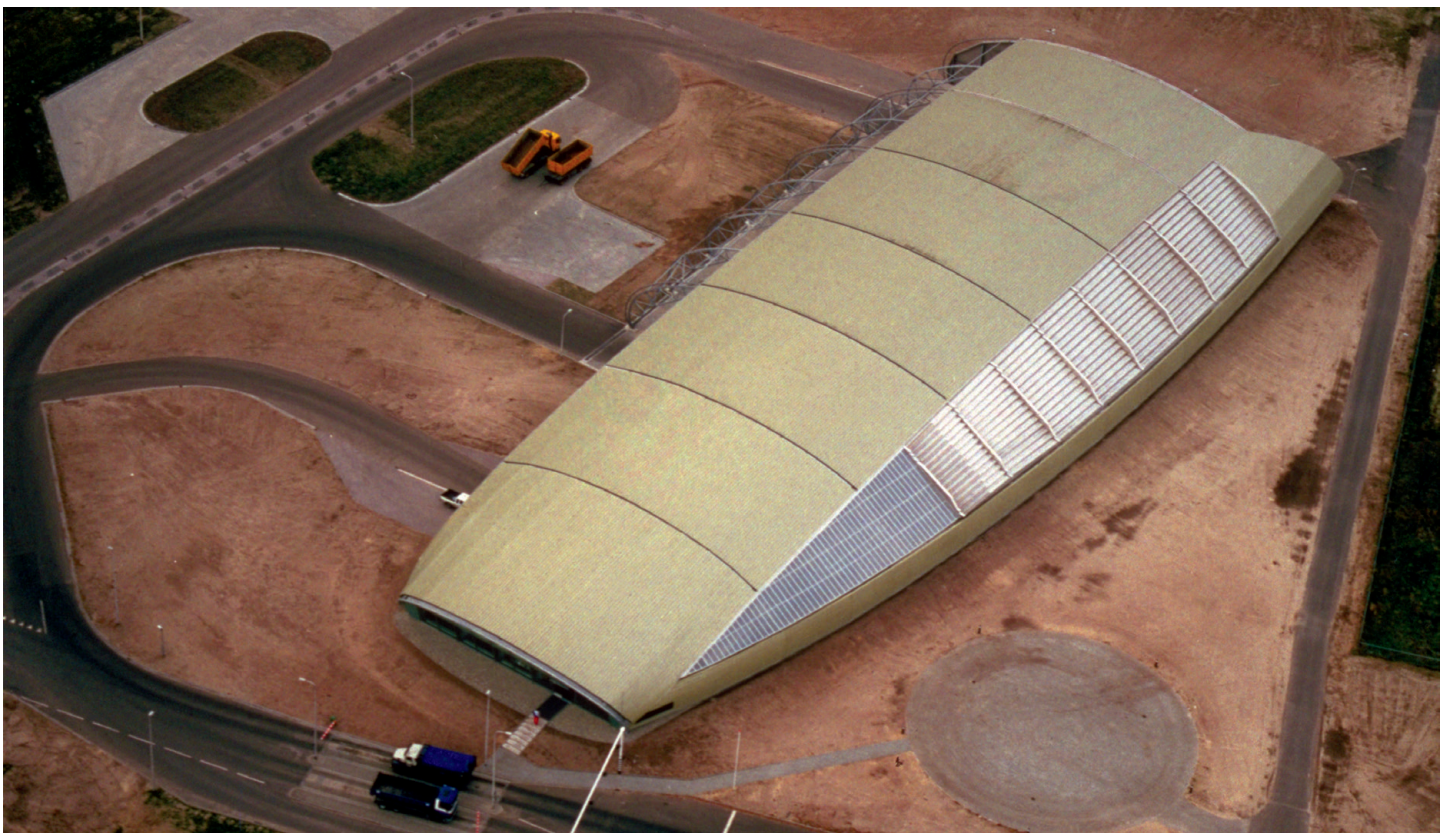


Figure 1.
Garbage Transfer Station
(1993)
Elhorst/Vloedbelt, Zenderen
Architect ONL
Source: ONL

dumpers driving in, dumping the garbage, sorting out the urban trash, and driving out to the trash mountain, while the ellipsoid evolved into a generous gesture shaping the doubly curved roof. By doing this we were able to combine the alien with the known, the intuitive with the functional, in surprising but equally falsifiable ways. The curvature that we introduced with the bold 160m long gesture embodies the series of programmatic functional blocks more effectively than a simple collage of rectangular functional blocks would have been able to achieve. The surface area of the doubly curved skin, embracing the whole building from head to neck to trunk to tail, is ca 15% less than the envelope of a rectangular arrangement would have covered. This discovery, that turned out to be an invention, inspired us to connect falsifiable data to the design model from the start of any project. The fusion of art and architecture on a digital platform was seriously beginning to take shape.

The *Elhorst/Vloedbelt*, as the building body is officially named, was recognized by the architectural community, receiving several awards, both internationally and nationally. It did hurt, though, that in the comments of a Dutch architecture critic the building was set aside in the *Dutch Architecture Yearbook* [1995] as an example of streamline style, therewith not honoring its potential as the rise of a new paradigm, that of *nonstandard complexity*. However, it was recognized internationally by curator Peter Cachola Schmal of the Blobmeister exhibition and accompanying book, in the good company of, among others, Marcos Novak, the author of the groundbreaking *liquid architecture* essay [*Cyberspace First Steps*, 1991] and Bernard Cache, the pioneering master of *parametric design*, a few years after Robert Aish's projects on *associative geometry*, but a decade before Patrick Schumacher's fashionable steps into what he now desperately promotes as *parametricism*. We are not in favor of any *-isms*. We were the pioneers of an elementary philosophy back then, disclosing a new paradigm, eventually leading to the paradigm shift from Euclidean geometry towards complexity based on simple rules. We adopted the theories of *liquid architecture* and of the *parametric* and developed them, in combination with our own intuition of the fusion of art and architecture on a digital platform, into our theory and praxis of *building bodies*, which are structures that are conceived as whole bodies, whether to be seen as sculptures thriving in the realm of the arts or as a built form of architecture.

Sculpture Buildings

Seen in retrospect, the 1994 *Sculpture City* event, which we organized with the support from Berry Koedam, owner of the RAM Gallery in Rotterdam, must be considered a milestone in maturing the theory of the fusion of art and architecture on a digital platform. Almost every aspect of modern digital life [Internet, 3d milling, virtual environments, interactivity, complexity, global connectivity, CNC manufacturing, associative geometry, serious gaming, the participation society, intuition and logic, sculpture buildings, programming, scripting, entropy levels] came together in the *Sculpture City* project, exactly 20 years back from now. Among others, Marcos Novak, Stephen Perrella, Lars Spuybroek and Maurice Nio, Leonel Moura were our guests. The main driver for the *Sculpture City* Event was not the innovative technology but the force of intuition, the force that wants to invade into the designing and the making of architecture, into the very pores and hidden niches of the design process; not intuition *per se* though, but intuition directly coupled to data, much in the manner of an idiot savant who would have direct access to massive data.

We challenged ourselves and the young professionals we were working with to do things we had not done before, and which had not been done by anyone else before. The only thing we instinctively knew was that in theory it should be possible to do it. The *Sculpture City Cloud* series of sculpture buildings were based on intuitive hand-made sketches by Lénárd, who is trained both as an actress [Dérényi Theatre in Budapest] and as a sculptor [Willem de Kooning Academy in Rotterdam]. Gestures are



Figure 2.
Cloud012_Sculpture City
(1994)
RAM Gallery Rotterdam
Architect ONL
Source: ONL

her natural way of expression. Each of her fast and furious intuitive sketches are completed within a second, therewith releasing high voltage energy. It was exactly that energy that we wanted to keep in *Sculpture City's* building sculpture proposals. We struggled to translate the powerful 2d sketches into 3d volumes that would frame this energy somehow. Later we learned how to directly sketch in 3d and how to directly transpose those sketches into 3d structures. Some proposals are more convincing than others, but all of them share that curious ambition, that level of absurdness that overtakes the cool functionalist reasoning, which is so strongly embedded in traditional program-based architecture. We succeeded in proposing structures that could be built using state-of-the-art CNC technology, structures that could live their lives in a marriage between the real and the virtual, structures that would behave in conversations with their users. Mind you, we are talking 1994, long before interaction design and social media became a major commercial component.

Inside the *Cloud* sculpture buildings, a virtual environment was running in real time, navigated by the users of the structure. This virtual environment was projected from within onto the surfaces of the *Cloud*, anticipating LED technology. Regarding the exhibition, we built a 1:20 scale model of *Cloud010*, including the projected navigable virtual world. The virtual environment consists of all 12 *Cloud* buildings, each of them having a characteristic behavior expressed through synthesized sound samples. The closer the navigator of the virtual *Sculpture City* would approach one of the *Clouds*, the more intense their specific sounds would become. After piercing through the skin of that *Cloud*, the navigator would hear its heartbeat, an experience that is equally reassuring as it is disruptive. Right at that moment it became obvious to us that buildings can have behavior; not as a mimicry of natural life, but as a new alien life form, something that was not known before. *Sculpture buildings* in the fusion of the real and the virtual would form a new nature, displaying behavior that feels natural but is fully constructed on the basis of simple design rules using state-of-the-art digital technologies. Some would be tempted to label it as artificial but we recognized it immediately as a new, very attractive form of life. From then on, the building bodies were no longer formal constructs but living entities with a right to live.

Real Time Behavior

In 1996 we were approached by Arno van Roosmalen who was then one of the art curators of the multidisciplinary art festival R96. We were invited to propose a temporary project in public space, and we came up with the concept of the *paraSITE*. Actually our proposal for 'parasites' was the first in a long series of 'parasite' proposals afterwards. But the way we spelled *paraSITE* in this case carried multiple meanings. We wanted the notion of the *parameter* to play a role in the name of the project, given that various parameters were used to bring *paraSITE* to life. We proposed not only a 'parasite' in the classical sense, but an 'object' that went through different 'sites' by its rich connections to a variety of web-sites on the Internet. We designed *paraSITE* to be a multidisciplinary web lounge that was driven by sound samples taken from its immediate environment.

ParaSITE was a true field lab; inside it, one had the feeling of being on an expedition into unknown territories, of being inside the alien. One would enter *paraSITE* via a slit in the skin. The structure itself was conceived as an inflatable sculpture, always slightly under pressure. For the design we intuitively modeled interlocking volumes using the lofting technique in 3dStudio software, the same software we used for the *Clouds* of *Sculpture City*. By that time, we already knew how to make the volumes appear softer and smoother. Thus shipbuilding technology developed to model doubly curved hulls and sails was introduced in our world of art and architecture on the now expanding digital platform.



Figure 3.
paraSITE_R96 Festivals
(1996)
Rotterdam
Architect ONL
Source: ONL

We invited composers who were somewhat familiar with digital technologies to work inside *paraSITE*. The composers did their explorative job well. They composed new musical forms, using the SuperCollider synthesizing software released in 1996, importing sound samples from passing trams, cars and people into the program. We agreed to give *paraSITE* a life-cycle of 15 minutes; within each life-cycle period, a new synthesis was programmed and a new executable behavior was performed. Depending on the samples used and on the parameters chosen, *paraSITE* would be calm and contemplative or wild and furious. We coupled the intensity of the sound to the ventilators that kept *paraSITE* under pressure, thus changing the level of pressure and therewith manipulating the level of inflation. Thus, the performances made *paraSITE* dance and shiver until midnight. After R96, *paraSITE* went on an European Tour to Budapest, Vienna, Helsinki and The Hague, absorbing new local influences, being reprogrammed by local composers, displaying new local behavior. This one *paraSITE* became many *paraSITES* in one, the seed of our understanding of multimodality in time and place that formed, a few years later, the theoretical underpinning of the provocative *Trans-Ports* project.

E-motive architecture

The black volume of our *Sensorium Waterpavilion* is a stranded sculpture; a bipolar building body; a furious sketch inside a bundle of slow curves in space; intuition coupled to logic; an alien life form; a multimodal experience; a participatory environment; an oceanic spaceship; File-to-Factory CNC production; Scripting; Programing; Real-time behavior; Sound and Vision; Real and virtual; Wet and ephemeral. Our saltwater sector of the *Waterpavilion*, linked to NOX's freshwater sector in the most minimal way, is the manifest expression of truly *e-motive architecture*. In the *Waterpavilion*, all the above comes together in the serious form of a robust 1000m² black body. The driving force behind the choice of the architects was again a representative from an art council. Abe van der Werff, Director of the Cultural Council of South-Holland [Culturele Raad Zuid-Holland], acted in close collaboration with master planner Ashok Bhalotra, [we owe him] and asked NOX and ONL in December 1993 to express the cyclic global water system, hence the choice for freshwater and saltwater sectors. Who said the client is not a co-designer? One should not underestimate the big influence of the client's vision on the content of any project, including iconic projects. Without this vision, in a bandwidth between narrow-sighted and open-minded, we would have never achieved something that could come even close to what has been realized today. This proves that everything we do is a joint effort of businessmen, the creative team, the engineers and the end-users in an environment that changes all the time. In fact all projects are somehow linked to the financial world market.

The *Waterpavilion* was one of those rare opportunities to build both shape and content. As for the shape, we were determined to realize on the building scale what we had developed the years before at the scale of models and simulations; it had to be a sculpture building, without compromises. Yet, we had to work within a strict budget. The question we were facing was how not to compromise. How to stay in control from scratch to delivery of the body and its content. We needed to develop new design tools in order to be able to stay in control. We quickly found out that, since no-one would fully understand our ambitions -and certainly not the new *trans-architectural* language we were speaking- we needed to be precise and specific in terms of geometry and the procedures for translating complex geometry into built form. After several iterations, we found what we were looking for: a smooth black body, shaped by the wind and the sea, with a navigable colorful interior, informed by a weather station on a buoy into the sea.

The price of the load-bearing steel structure was confirmed by the steel manufacturer, Henk Meijers of Meijers Staalbouw. The knowledge of the steel manufacturer



Figure 4.
Sensorium Waterpavilion
(1997)
Neeltje Jans
Architect ONL
Source: ONL

turned out to be crucial for the project's success, for both our sector and NOX's sector. He had had the CNC machines for 15 years already in his factory, but no architect had ever requested to use them in a nonstandard way. They were only used for repetitive jobs. We were the first architects to actually use those machines to their full potential. Meijers, though, knew what his machines were capable of. We sat together to find out what data the CNC machines would need to do their work, which was cutting the steel at continuously changing angles. Basically, what he needed was a spreadsheet with angles. We realized that the most effective way to produce the data needed was to describe the structure by scripting, instead of providing the manufacturer with a CAD drawing. That was revolutionary. From then on, we knew that the making of architecture does not require drawings at all. It needs data and communication protocols between one machine [our PC] and the other [CNC machine]. We needed to organize machine-to-machine communication and create a direct link between file and factory. Soon it became clear to us that this file-to-factory method implies an explosive threat for traditional contracting procedures.

The behavior of the *Waterpavilion's* building body is informed in real time by the weather station. We actually tapped the raw data from the weather station, used them as parameters in our lights and sound design algorithms and transposed them into MIDI numbers [1-128], steering the lights and the sounds inside the *Wetlab* and the *Sensorium* via a pop concert-style mixing table. The weather station was continuously monitoring wavelength, wind speed, percentage of salt and temperature. The incoming data were constantly changing, and so did the interior atmosphere of the pavilion, creating new combinations of the full color-lit glass fibers [stretching from one pole of the body to the other] and the sound samples. Its behavior could never be repeated.

The body that was now enriched by its *emotive* factor became a disruptive technology; it came so close to one's senses that it was a deep experience indeed. For many unprepared visitors, though, it was more of a nightmare than a trip to paradise, as it repelled them out of their comfort zone. Even my best friends were discomforted by the whole experience, ending up asking themselves serious questions on the meaning of life after the visit. My father, who was eighty-eight years old then, even refused to enter the building after a few steps, since it destabilized him, making him feeling insecure about whether he could trust the floor. How accurately did he describe then the situation of contemporary buildings! We take for granted that floors are flat, that walls are built straight up, that the light provides so many LUX and so on. Basically, one expects buildings to operate within certain comfort zones, targeting to optimize that form of comfort. In order to improve buildings, we typically consider making the floors flatter, the indoor temperature more constant, the walls more flush, the lights just right. The *Waterpavilion* changed all that; a new paradigm was born on the scale of building. From then on, comfort zones were subject to design intentions.

Multi-player game

In 2000, Massimiliano Fuksas invited us to take part in the Venice Biennale. He assigned us the upper central room in the Italian Pavilion, the same room that was taken, in later editions, by Eisenman and Koolhaas. Seen in retrospect, we think that Fuksas' Biennale was by far the most experimental one we have seen. Today the Biennale tends to become more and more a platform to re-stabilize the foundations of architecture and to retro-actively search for fundamentals, which are to a large extent the fundamentals of the fifties and the sixties [Koolhaas' Biennale theme for 2014]. They are certainly not our fundamentals. Our fundamentals are: industrial customization, file-to-factory, interacting agents, smart building components, real time behavior, complexity, synthesis. His fundamentals [when it comes to building] seem to come to a full stop at the typical modernist fascination of mass production, based on a cynical view on the potential of architecture to precognize paradigm shifts.



Figure 5.
Trans-Ports Hand-drawspace
(2000)
Venice Architecture Biennale
Architect ONL
Source: ONL

Building upon earlier projects and having become aware of the potential of game development platforms [games are played in real time] we imagined, back in 1999, a joint project together with Marcos Novak. We imagined a building structure that would respond to an action taken at the other side of the world. Since we both lived in port cities, I wanted to use the word *Port* in the name of the enterprise. Since Novak had already coined the term *transarchitectures*, as the logical sequence of *liquid architectures*, we decided to name the project *Trans-Ports*. The intention was to build two prototypes, one in Los Angeles and one in the Netherlands, but eventually only our version was realised. We took the opportunity of the invitation to build the first virtual prototype of such a responsive and, as we soon discovered in essence, pro-active structure. We built an interactive arena that was covered by an array of infrared sensors located in the ceiling. The arena was divided in three concentric zones, triggering a specific interaction with the virtual environment that was projected on three large 4x6m screens around it. Changing parameters drove the content of the virtual environment as moving in the arena meant triggering one or more of the infrared sensors, designed and installed by Bert Bongers, who now runs his *Interactivation Lab* in Sydney. The interactive installation *Trans-Ports* knew three distinct modes of operation: *Handdrawspace mode*, *Floriade mode*, and *Trans-Ports self-explaining mode*. *Handdrawspace*, as designed by Lénárd, is best understood as an abstract interactive painting. The *Handdrawspace* world consists of a number of 3d freehand sketches, emitting particles in real time, built in the game development platform *NEMO* [as it was called by the time, then renamed into *Virtools*, and later taken over by Dassault and renamed again *3DVIA Virtools*]. We built the *Handdrawspace* world as a parametric system where the size of the dots, as well as their number, and the background colors are subject to change. The visitors of the venue in Venice could change these parameters by changing their position in the arena. The condition of built constructs that we were aiming at then was a process of continuous operation, while the people could interact with that built construct by stepping into the process and participate as actors. We took that bold step from the experience economy into the participation economy, where citizens are no longer considered as consumers but as active players in the multi-player game of life. From here on, this would be the basic condition buildings should be in as from the very first design concept. We consider buildings as vectorial bodies that can change shape and content in real time.

Spaceship

Five years after the *Waterpavilion* project, another challenge crossed our path. The director of the Cultural Council of North-Holland [Culturele Raad Noord-Holland] invited us, after having considered Ben van Berkel of UNStudio, to design their pavilion on the Floriade World Expo 2002 in the Haarlemmermeer, the same Expo that gave the floor to Asymptote to realize their first building [Hani Rashid and Lise-Anne Cou-ture owe them]. These Cultural councils, that were very strong in The Netherlands in the previous decade, have lost much of their power due to severe budget cuts by the latest populist governments Holland is confronted with since 2002, the year that the provocative anti-Islam politician Pim Fortuijn was shot to death. With the death of Fortuijn the [multi]cultural sector of The Netherlands was doomed. The *Web of North-Holland* was the last commission we received via the cultural council system.

After a first round of design proposals, we found out that their budget was limited to exactly 1 million guilders [the Euro first came in 2002] for the building, and another 1 million for the internal experience of North-Holland. Unfortunately, the Board of the Cultural Council decided that the interior experience could not be given to an architect. It had to be commissioned to a media specialist, and as architects we were not credited to be media specialists, although we had proven to be one of those too. But according to the bureaucrats, one can only be one specialist at a time. So we had to focus on the body, not on the content. To get through the second round of decision



Figure 6.
WEB of North-Holland
(2002)
Floriade World Flower Expo
Architect ONL
Source: ONL

making by the board, we proposed a pure flat ellipsoid shape, beautifully made by a metal workshop, like a spaceship that would softly land on the Floriade exhibition terrain. We remained faithful to the spaceship metaphor in the stages of the design process that followed, but we changed its shape to become a nonstandard building without compromise. They accepted.

The making of the spaceship was another story. After lengthy discussions and unsuccessful attempts to materialize our design proposal by the space frame builder Octatube, we decided to develop the structure as a product ourselves. Within one week we came up with a structural proposal that was adopted and financially backed up by Meijers Staalbouw, taking the nonstandard paradigm to the extreme, both for the structure and the skin. Under high pressure, we built the foundations for another milestone project. After having modeled-shaped the body in Maya, we invented a structural system that is following the doubly curvature. This was a different and better approach than the one used for the structure of the *Waterpavilion*, where we still were bound to apply the linear French fries cutting system. On the basis of a twisted dodecahedron, we constructed, perpendicular to its surface, a system of reference lines for the steel structure. Since these reference lines were not parallel, due to the nature of the doubly curvature, we needed to impose a fold on the steel components. We ended up with a system of hundreds of unique steel components bolted together to form the assemblage of the *Web of North-Holland*. All nodes were different. As for the doors, being a specialization of the node, we inserted a hinge while doubling the component. Not a single component of the *Web of North-Holland* was taken from a catalog, not even the canopy-door. Instead, we built our own project-specific catalog.

That became the driving procedure for the realization of our nonstandard buildings from then on, with the *nonstandard paradigm* being one level up from the standard methods. "One level up" means that the *nonstandard* includes all possible configurations, covering every possible boxy building as well, while the other way round, the *standard* method of operation, that is based on mass-produced products, simply excludes the nonstandard. Interestingly enough, that makes the nonstandard way a generic method, with traditional modernist architecture becoming a specific instance of the nonstandard.

A Very Long Straight Line

Therefore, complexity is generic, and complicatedness is specific. To fully understand the power of the nonstandard, it is necessary to make a clear distinction between the complex and the complicated. After five years of conceptual design that started in 1998, we were granted the opportunity, by Mrs Nora Hugenholtz, Director of the Projectbureau Leidsche Rijn in Utrecht, to build the 1.6km long *Sound Barrier* with the *A2 Cockpit* building embedded inside its long elastic lines. The project was completed by the end of 2005. She was charmed by our concept and was taken by the advantageous commercial concept as well, since we embedded a complete 6000 m² building in the sound barrier, thereby seriously augmenting the amount of gross floor area the city could sell. This design concept actually is sustainability in its pure form because of the double usage of the earth, due to changing the separation of functions into the integration of functions; CIAM was finally challenged.

The making of the *Sound Barrier* implied inventing a parametric design-to-manufacturing system that would allow us to produce and fit together 40.000 unique pieces of steel and 10.000 unique pieces of glass. This would not have been possible without a scripting-to-production process. The obvious next step in the file-to-factory was taken. We scripted the procedure in Maxscript to measure the swarm of components and their mutual relationships. The script produced a dataset that was directly pumped into the plotter language to drive the new CNC machines that were ac-



Figure 7.
Cockpit in Sound Barrier
(2005)
A2 Highway Leidsche Rijn, Utrecht
Architect ONL
Source: ONL

quired by Meijers Staalbouw. Working together in a Design & Build fashion, we were able to offer the city the complete structure as a product for a fair fixed price, there-with counter-attacking the calculation that was made by the established engineering office Witteveen & Bos, who estimated the structure to be exactly twice as expensive as the given budget. Only by taking control over the data and by taking full responsibility over the correctness of the data we could secure the project. Projects like the *Sound Barrier* and the *Cockpit* are simply not feasible when following traditional linear methods of tendering. By taking control over the data flow and by securing that nothing is lost in translation, we are able to save 20% of the costs in each step of the building chain, eventually leading to a 100% reduction with respect to traditional risk analyses by established engineering firms and contractors. However, this only works when the data diet of the manufacturing process is made to form integral part of the design system. Nonstandard does not work as a post-optimization process. It must be between the ears of the designer, from the very first conceptual thought, and applied at least to the integrated structure and skin of the building.

Buildings that are conceived according to the paradigm of complexity based on simple rules and on an open design systemic approach are not shapeless. Explicit shape does matter, but different from a traditional linear design process. While the complex webs of nodes and edges of the *Sound Barrier* and the *A2 Cockpit* follow their own internal rules, at the same time these rules unfold within the boundaries of a shaped bounding box, which is the 3d model. The 3d model is defined by long elastic lines, and one of those lines is, as seen from the top, a perfectly straight line of 1,6 km. Therefore we are very reluctant to categorize our buildings as blobs. Blobby designs, such as we have seen from designers like, among others Lynn, Van Egeraat, Spuijbroek, Jakob + MacFarlane, can be adequately typecasted as streamlined potatoes since these architects do not vectorize their complex design systems, but accept their system to boil and bubble on an otherwise earthbound position, while we always inform our complex adaptive system with a vector as to fly and float and as to chose a direction. The sea of possibilities that digital technology offers requires one to choose a direction, based on a developed opinion on the direction, strength and curvature of the vector. In our view, each complex adaptive system represents a node in a web of surrounding and invading complex adaptive systems of various dimensions, exchanging data and information via information highways that are woven as invisible filaments between them.

Powerlines

The fusion of art and architecture on a digital platform indeed brought us what we wanted back in the early nineties. Also our larger projects like the *CET* in Budapest and the *LIWA Tower* in Abu Dhabi are sculpture buildings with vectorial bodies without compromise. At the same time they are testimony of innovative digital design strategies as well. They can be seen as an intricate fusion of bottom-up and top-down strategies, whereas the signature *Powerlines* are top-down imposed on the bottom-up generated open design systems. The powerful gesture is always there in our projects, a direct heritage from the critical-paranoid method of intuitive sketching. Salvador Dali described the critical paranoid method as follows: “*spontaneous method of irrational knowledge based on the critical and systematic objectivity of the associations and interpretations of delirious phenomena*” [www.salvador dali.com]. And the generic rationale is always there in our work, and these seemingly opposite attitudes are in a painfully precise way fused, by exchanging the essence of the immediate and the emotive with the deliberate and systemic via data, written in a project-specific digital language that both the intuitive and the logic can learn to speak.



Figure 8.
CET/Bálna
(2012)
Budapest
Architect ONL
Source: ONL