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Cecil Balmond
New Structure and the Informal

Further Notes on the Design of the Chemnitz Stadium

The idea of the Chemnitz Stadium was to break away from the traditional language of stadia design. Usually, the geometry is concentric and rigorous in plan, forming parallel rings. In elevation and cross section, the roof is coupled to the seating stands. Both in plan and elevation, the form is predictable; quite in contrast to the fluid and random energies of the games themselves.

The architects Peter Kulka and Ulrich Königs decided to take as a starting point the unpredictability of a dynamic system that serves as a metaphor for sport itself and for the vagaries of chance. They chose a plan form that offered several possibilities.
Chemnitz Stadium. Nov 95. - Carll Behnisch.

The idea of Chemnitz was to break away from the traditional language of stadium design. Usually the geometry is concentric and rigorous in plan, forming parallel rings.

In elevation and cross section the roof gets coupled to the seating stands.

Both in plan and elevation the form is totally predictable, quite in contrast to the fluid and random energies of the games itself.
on axis: one orbit for the track; one orbit for the seating; one orbit for the roof.

In elevation, track and seating would be separate zones and the roof would free itself of constraints.

The basic idea was to fix the track in the landscape, then place the seating tiers as a floating object over which would hover a cloudlike roof. In between air and heaven and ground and sweat and energy, the vertical lines of connection would have to be random, opportunist, serving multiple needs. There would be no coherent, uniform Cartesian logic to the situation.
The final proposal sketched out track, seating, and roof:

The roof outline followed the site boundary closely. The floating shape of the seating orbit could be solved structurally simply by placing columns underneath.

But how would the roof be solved?

The traditional solution would be to see the roof as a series of cantilevers.

There are two problems with this approach. First, the concentric form dominates and makes the initial proposal look artificial.

Second, structural cantilevers require good back span, which was not available where the site boundary and roof back line neared the back of the seat line.
The Structural Solution

The problem of back span arose in three zones of Kulka and König’s proposal.

Instead of searching for an external, universal system, it seemed more promising and intuitive to look for a “local” solution. Turning constraint into potential, we bypassed the problem by arching into space. The three resultant half rings act in torsion as the load is taken back to the edge.

To relieve the torsion from building up, other arch forms in plan have to interconnect. As the process repeats and multiplies, a structural mesh or net forms.

Where the roof moves over the ground, outside the back of the stand, several column positions are possible. These columns help to limit the size of roof elements but also serve to generate more longitudinal lines along the roof.
It was now possible for us to cut the roof in longitudinal strips, liberating the form from any concentric ideas.

The roof's structural net need not be horizontal in elevation, but can rise and fall to produce greater stiffness. This effect, coupled with the longitudinal possibilities for the roof plane at different adjacent levels, creates the desired cloud.

Note that no amount of freedom for the roof plan would have kept the "natural," random feel of a cloud had a traditional cantilever solution been used. Running straight lines to the edge "hardens" it and implies an outer concentric line, so that symmetry is forced onto the design.

Breaking away from this Cartesian logic allows for the net structure, which is adaptable to freer form.
We initially conceived the structural net as flat; we then let the section undulate.

We also considered that some of the rings could start from the ground to give an overall arch effect; however, this might destroy the feeling of a cloud for the roof.

Instead of arch forms hitting the ground, inclining some of the columns serves to stiffen the roof laterally, maintaining the floating effect of the cloud. From points along the primary structure a grid can be hung. From this plane, further droppers can be placed as stretch points for fabric.

Between the main trajectories of the net a variety of grid types can be developed; or warped solid surfaces; or just void.
Overlap

The site is open to all possibilities. The ground invites tracings and marks that may be random or ordered.

In the beginning an idea has no boundaries, only potential. We used a grid to transform speculation into reality. But a grid laid on the ground projects its logic into the vertical space above it. The three-dimensional grid becomes a container imposing order in all directions. It is a straightjacket that cuts into movement and traps it.

To allow more fluid possibilities we enacted an informal freeze/melt scenario: taking a grid and duplicating it, then rotating the new grid randomly, creates an overlap of points.

The pattern of node points is random but belongs to a family of grids.

If we connect an intersection of the roof net to one of the grid points on the ground, we can develop a forest of columns that is natural in order yet buildable through the logic of overlap. We have now obtained the full potential of the idea: a cloud and a forest; the natural overlapping with the artificial in roof and columns.
A Postscript to the Design Process

Rotation

At the competition stage, the multiple structural rings that provided our solution were placed by eye. Did intuition have any rationale to it, could the patterns of the roof net itself be derived by other means? Did chaos, in the mathematical sense of deterministic algorithm, have anything to do with it; could we produce different outcomes from different start points? In other words, could the roof pattern be self-generated by a chaotic rule? The answer lay in a rotating disk.

As the holes vary in position, the trace breaks down into a wild scatter or it comes out symmetric and even. If further complexity is added and the discs expand and contract, rolling tangential to set contours, such as between a site boundary and a fixed running track edge, then a net of rings forms.

If the disk runs round and round, the “weave” thickens and grows. An infinity of solutions is possible.

Imagine a black disk in a darkened room. Make a few holes in the disk; shine a light through the holes. Let the disk rotate and track the light: traveling waves in the geometry of overlapping cycloids emerge.
Some weaves suggest cane work, some reef coral; others give rainbow symmetries. Different traces suggest different objects. The results jump scale. Pattern governs the interpretation.

Various properties can now be given to the strands and parameters stitched in to seed “intelligence” into the overlapping interactions. What looks so free is actually held together by internal strategies. There is a curious understructure to the ensemble; and though we read “free form” something else is felt, a sense of nature and of order.

The informal

The informal is neither random nor arbitrary, it relies on overlap to bring forward a series of shifting certainties; its logic is contingent on initial conditions. “Chaos” is thus a succession of several orders, quite different from the idea of trapping the arbitrary and calling it order.

The twisting in and out of a Möbius strip is informal. A roof that becomes wall and floor, a floor that is skin, where boundary does not mean border, is also part of it. Two columns out of step, side by side, of different shapes and material are part of it. Instead of regular, formally controlled measures, varying rhythms and wayward impulses take root. Opportunity is seen to give chance, a chance.

The classical determinism of Newton pictured force as an arrow, straight and true. It bridged the void in unwavering linearity — the fixed link of a rigid logic chain. Now we see force differently, as a minimum path through a field of potential. Dependent on local conditions, this path may vary but the trajec-
tory is based on instants of mutual cooperation, a simultaneous juxtaposition.

The informal offers no distinct rules, no fixed patterns to be copied blindly. If there is a rhythm, it is in the hidden connections may be implied but are never obvious. The answers lie in the relationships among events. Hybrid situations are considered valid starting points and not unfortunate accidents. Two events close together are seen as dynamic rather than exceptional, sending out particular vibrations.

**New Structure**

New structure is a dynamic inquiring into form and configuration from first principles. It admits into the solution the complex as a priori. New structure takes overlap and ambiguity as a basis for design and discounts the stringent notion of order along Cartesian lines.

New structure animates geometry, it reawakens an original inspiration of form. In this scenario, buildings become rhythm and sequence and clash and confrontation; if symmetry exists, it is in the active joining of separate tendencies, in balance for only one moment. Rejecting the pursuit of an external object dissected and subdivided according to a fixed grid, new structure follows a holistic approach of inner logic informing the whole.

Structural solutions that arise from the informal impart hidden energies to a building. The connectivity happens through improvising; the equilibrium comes together in ad hoc instants. The informal acts as an agent of release. The topography of such buildings is different, producing with an intuitive rational a new kind of structure.

In the name of modernism, a final stripping down of form has taken place in which structure has been relegated to mute submission. The result is a giving over of thought to blankness and transparency, glass
and steel in an evaporating substance. Reductionism has reached its dead end; minimalism is now a reward label.

Twisted, shameless multiplications of surface or texture of form seem nowhere to be found. The desire is to conform, to offer up constructions in orthodox containers, without the pleasure of elaborations — no syncopated rhythms, nothing irrational and spontaneous. But why not a new multiplicity, the idea of a new Gothic or new romantic? Why not new structure?