Before the Algorithm:

Drawings as Instruments of Parametric Control in NOX's Water Pavilion, 1993-1997

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INTRODUCTION

Lars Spuybroek, along with the Rotterdam-based firm NOX, conceived the design of the freshH2Oexpo, a water experience pavilion in Neeltje Jans, Netherlands, in 1994. Completed in 1997, the pavilion has since become one of the most discussed buildings of late twentieth-century architecture: a continuously curved topological shape where floor, wall, and ceiling merge into one undulating surface. Visitors had to navigate through a geometry that lacked a datum plane, orthogonal axes, and traditional separation of spaces. Praised as one of the early attempts in digital architecture, the Water Pavilion has been celebrated for its innovative form, interactive electronics, and theoretical basis in the work of philosophers such as Merleau-Ponty and Deleuze.

However, while scholarship on the Water Pavilion has always focused on its exterior form, interactivity, and theoretical background, its production has been largely overlooked. The objective of this thesis is to fill this gap in the literature by analyzing the drawings of the Water Pavilion. In particular, the key argument made here is that lacking associative parametric software at that time, the drawings of the Water Pavilion did not simply record a predetermined geometry but rather functioned as a powerful tool to encode the rules governing the translation from digital design to actual architecture.

What role did architectural drawings play in the parametric control of geometry to allow the complex digital architecture of the Water Pavilion to be built in the absence of associative parametric software?

This topic requires an understanding of the intersection of drawing studies with the nascent field of digital architecture, an intersection not sufficiently studied before. The primary sources include the design documentation contained in the archive collection AP173, namely a series of hand and computer drawings created between 1993 and 1997 (schematic plans, numbered sections, systems diagrams, etc.) As additional sources for the analysis of the design process, there is Lars Spuybroek's own monograph NOX: Machining

Architecture as well as the interview with the architect conducted as part of the research. The primary value of this interview consists of Spuybroek's firsthand account of the design process and answers to technical questions pertaining to geometry control that cannot be obtained from any secondary sources.

For setting the historical and theoretical context, the secondary literature is used selectively. Works by Antoine Picon, Rivka Oxman, and Greg Lynn give insight into the conditions of digital design in the 1990s and, as such, are not the focal point of the thesis' analysis. [1]

The paper is structured into four chapters. Chapter One provides historical context and sets up the argument that the tools available to the designers of the late 1990s presented inherent limitations in terms of automatic processing of geometric dependencies. The analysis of the design documentation proper begins in the second chapter where the parametric intelligence of the drawings is uncovered. In Chapter Three, the focus shifts to the role of drawings as parametric tools in translating the geometry of the design to the built form. A short conclusion follows.

CHAPTER 1: BEFORE PARAMETERS - DIGITAL TOOLS AND THEIR LIMITS IN THE 1990S

1.1 The Promise of the Digital and the Limits of the Software

The early 1990s were notable in this regard according to Antoine Picon's statement that at the time there existed a significant incongruity in architecture practice due to the fact that while the new technology in the form of the digital computer allowed for architects to create an unprecedentedly complex shape, the software used in it could not yet integrate these shapes in a proper manner. The programs such as Alias and Softimage borrowed from industrial design and film animation allowed NOX to develop models of three-dimensional, seamless surfaces. Still, these models failed to establish any kind of automatic connections

[1] Antoine Picon, *Digital Culture in Architecture* (Basel: Birkhäuser, 2010); Rivka Oxman, "Theory and Design in the First Digital Age," *Design Studies* 27, no. 3 (2006): 229-265; Greg Lynn, *Animate Form* (New York: Princeton Architectural Press, 1999).

among their different elements. Changing one thing automatically updated no other parts of the model: all dependent drawings had to be manually modified.

The problem in question was not only technical in nature but carried with it a serious implication regarding the transferability and storage of the knowledge embedded in architectural designs. The current state of things in this area includes using parametric software like Grasshopper which is able to incorporate the rules governing the process into the very structure of the model: changing one point updates geometry, sections and structural components accordingly. In the mid-1990s, no part of this software was capable of doing that. The only way out was externalizing this information by making the drawings do the work. [2]

In this regard, the Spuybroek's explanation of what was done in 1993 can be considered very accurate and clear-cut. He says that "Most of it was done by hand and loads of diagrams linking the sections and a set of lines on the plan. I think diagramming was the precursor to code: not as precise but certainly more intelligent." [3] His point is not in making fun of the old methods but rather in establishing a certain paradigm shift which involves making the drawings do the work of the code. In fact, drawings constitute the parameter set in such case.

1.2 NOX and the 1990s Experimental Context

The Water Pavilion was not designed in a vacuum; instead, it emerged at a particular time in European architectural experimentation during which a select few firms attempted to explore the potential of digital geometry and develop the technology necessary for its realization. In the case of NOX, the context of this exploration was influenced by the intellectual atmosphere of the Delft Faculty of Architecture, as well as the work of Rem Koolhaas and his firm OMA, who were notable in their commitment to analyzing programmee and section through the design process. While NOX was engaged in a different practice than Koolhaas, prioritizing the experience of movement and continuous

[2] Oxman, "Theory and Design," 234.

[3] Lars Spuybroek, interview by author, March 3, 2025. All subsequent quotations from Spuybroek, unless otherwise noted, are drawn from this interview.

surface over the programmatic diagram, their design was also informed by an interest in precise representation in the process from concept to building!

One of the key things that set NOX apart from contemporaries, including Greg Lynn's FORM (whose Embryological House project 1997-2001 considered parametric variation as a generative process), was the commitment to the singular object. The Water Pavilion was not an example of a series of objects designed using parametric techniques. Instead, it was a unique building on a specific site with a specific programme that required a unique system of drawing for its design.

1.3 Parametric Thinking Without Parametric Software

Parametric design, historically speaking, is understood as a practice enabled by computerized algorithms developed in the 2000s, with "parametric architecture" being such a common designation for works made by means of software like Grasshopper or Catia that there seems to be little point in considering any relevance that parametric methodology might have for either pre-computational or early-computational practice. As Oxman asserts, though, parametricity as a way of defining form by means of relational variables rather than geometrical constraints is not necessarily computational. On the contrary, it represents a design strategy that defines shapes "in which 'the relations between components are more fundamental than the components themselves'".[4] It is important to make a distinction between the parametric logic on one hand and parametric software on the other.

A number of historical examples illustrate the application of rule-based geometrical control in architecture. For instance, Gothic tracery, Baroque ceiling frescoes, and Beaux-Arts plan compositions used proportions and geometrical dependencies dictated by drawing conventions, without relying on any software. The breakthrough of the 1990s consisted in the use of digital geometry in designing forms beyond the possibilities of traditional drawing conventions. What was needed to do was not to invent a new design concept, but to develop new techniques of drawing in order to apply the old concept to new geometries.

The genesis of the Water Pavilion design is well-explained in Spuybroek's own account of the project. The main idea of the form came out of a simple ellipsoid tube. Further transformations included, in particular, the scale adjustment according to program needs, as well as deformation depending on certain site parameters, such as wind directions and orientation towards incoming visitors.[5] Thus, the resulting structure can be

4 Oxman, "Theory and Design," 235.

5 Lars Spuybroek, *NOX: Machining Architecture* (London: Thames & Hudson, 2004), 18.

characterized by an S-shape of its plan, which changes in shape gradually from the entrance to the exit. While the first part of the structure features a vertical ellipsoidal cross-section, the last part features a horizontal cross-section. All the cross-sections are unique, and the floor itself never becomes completely horizontal. There are no regular orientations within this structure.

1.4 The Drawing as the Site of Parametric Control

It is only through the lens of the particular problem of construction that the drawing system employed for the Water Pavilion can be fully comprehended. In the case of the Water Pavilion, the building was conceived as a series of transverse cross-sections determining its shape at certain intervals throughout its length. The geometry in the spaces between those sections is determined by ruled surfaces: those generated by the straight lines between corresponding points on the curves in neighboring sections. This does not involve double curvature, according to Spuybroek. "There is no double curvature (except for two small spots)." What appears in photographs as an organic whole, the seamless building, is actually an assembly of ruled surfaces held together by planar sections.

This means that the implications of the drawing system for the architecture itself are enormous. The fundamental determination of the form of the building by way of its sections entails that the sections themselves are the tool of control. Change of any one section will affect the ruled surfaces that flank it. The complex of relations between sections is the parametric essence of the architectural design. The question of how those relationships are established and maintained—and thus how changes made in one section are passed to neighboring sections and ensured within the integrity of the whole of the S-curve as recorded in independent two-dimensional drawings—is precisely the core question posed by the archive of drawings.

This was precisely what Spuybroek identified as "the manual propagation" of change. "Most of it was done by hand and loads of diagrams linking the sections and a set of lines on the plan." This is the essential nature of the parametric design system as recorded in the archive. The diagrams played a functional role in ensuring the coherent relationship between sections within the architectural system; they were more than decorative. The next chapter analyzes them. [6]

[6] Ibid., 22-23.

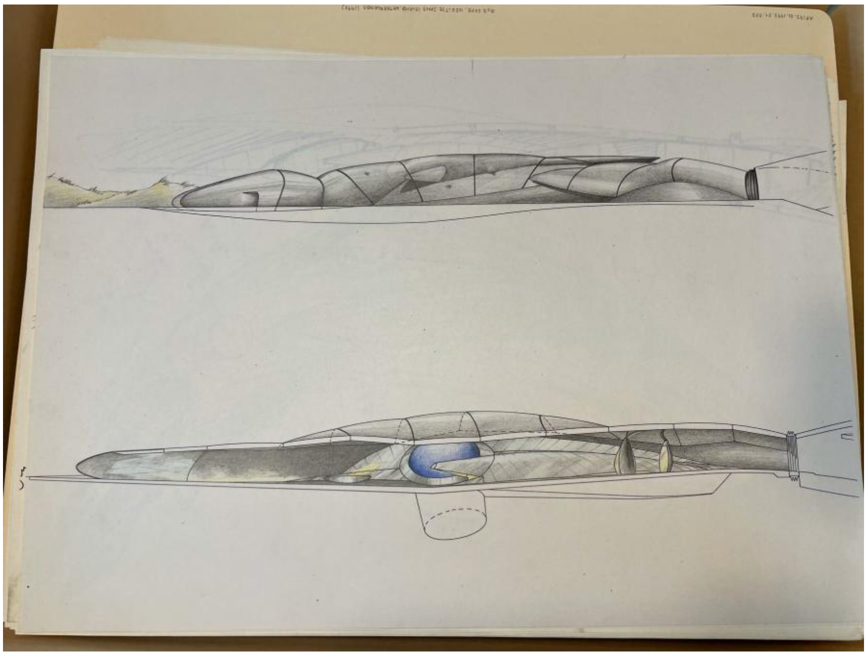

Figure 1. Longitudinal elevation and coloured section, Water Pavilion (freshH2Oexpo), Neeltje Jans, 1993. Hand-drawn. AP173 collection. The drawing establishes the overall S-curve of the building and the interior spatial sequence, with colour annotations indicating exhibition zones.

CHAPTER 2: THE DRAWING SYSTEM - SECTIONS, DIAGRAMS, AND PARAMETRIC CONTROL

2.1 The Archive as Primary Source

AP173, from the CCA Collection, contains an assemblage of roughly forty-eight drawings related to the Water Pavilion, ranging from schematic drawings through to complete sets of detail drawings. The drawings considered in this chapter concern themselves with the design development stage; they are working drawings that are annotated by hand and show the rationale behind the decision-making process, not just the results of that process. The documents considered here contain three distinct types of information directly relevant to the arguments of this thesis: the serial transverse sections (numbers 01-19), the systems diagrams superimposed on the plan view with color-coded annotations, and the height diagram describing the elevations at the location of each cross-section.

In isolation, these documents seem quite ordinary as drawings for architecture. The sections are basic line drawings; the diagrams are schematic; the annotations are succinct. The importance of these drawings is found in the relationships between them and, by extension, with the three-dimensional form created by those relationships. Taken together as a coherent system, these documents comprise a parametric definition within a drawing-based parameter set, where a set of constraints on the geometry is defined in two dimensions, from the entire S-curve down to the locations of specific trusses.

2.2 The Section Series: Geometry as Sequence

The section series can be regarded as the most direct way of expressing the parametric nature of the pavilion's structure. Nineteen numbered sections are placed along the entire length of the building, each one revealing the form at a certain point along the S-curve. In their totality, the sections represent a series that defines the main geometric transformation involved in the project, which consists of the rotation of the ellipse profile from a vertical position to a horizontal one, together with scale variation in order to incorporate the programme. [7]

The logic of the series works on two different scales. On a large scale, the series reflect the deformation of the building from the entrance up until the well located at the center of the structure, i.e., the gradual widening of the section combined with the change in ellipse orientation. The deformation is not random: it follows a certain rule: the ellipse is being rescaled and rotated, based on the programmatic needs and the context, in other words. The above rules are implicit within the geometry of each particular section but manifest explicitly in reading the whole series.

On a smaller scale, the sections determine the exact geometry of the structure as expressed to the steel contractor. According to Spuybroek, the contractor was given two-dimensional sections measured up to the millimeter along with XYZ coordinates for each structural node, rather than a three-dimensional model. Moreover, each curve in the sections is a combination of several circular arcs, which are necessary due to the limitations of the AutoCAD version 11, and each arc is associated with a radius constructible by the rollingmachine.

[7] Spuybroek, NOX: Machining Architecture (London: Thames & Hudson, 2004), 18-22.

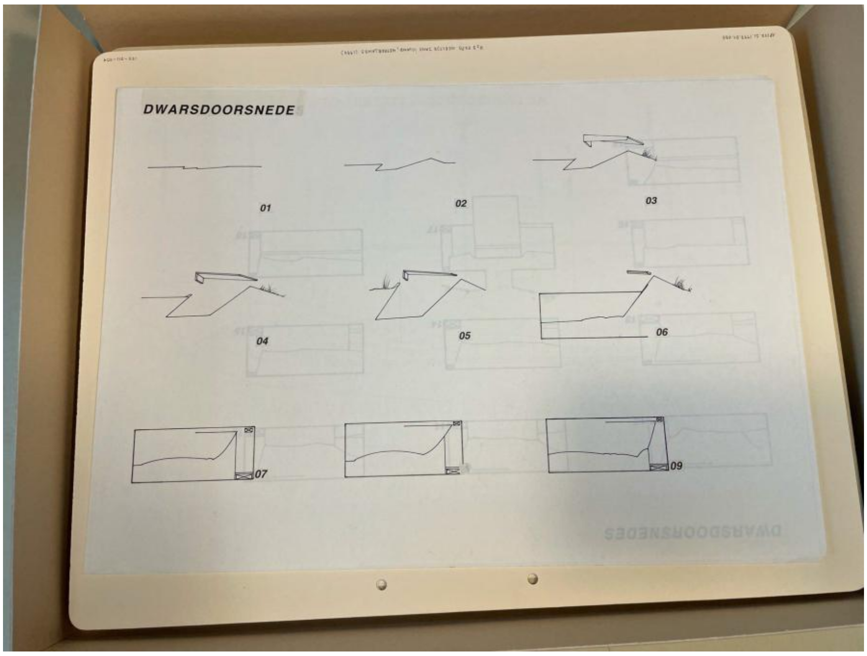

Figure 2. Serial transverse sections 01-09, Water Pavilion (freshH2Oexpo), 1993. Printed drawing with hand annotations. AP173 CCA collection. The sections are numbered sequentially along the longitudinal axis. Each section is unique; the progression from vertical to horizontal elliptical orientation is visible across the series.

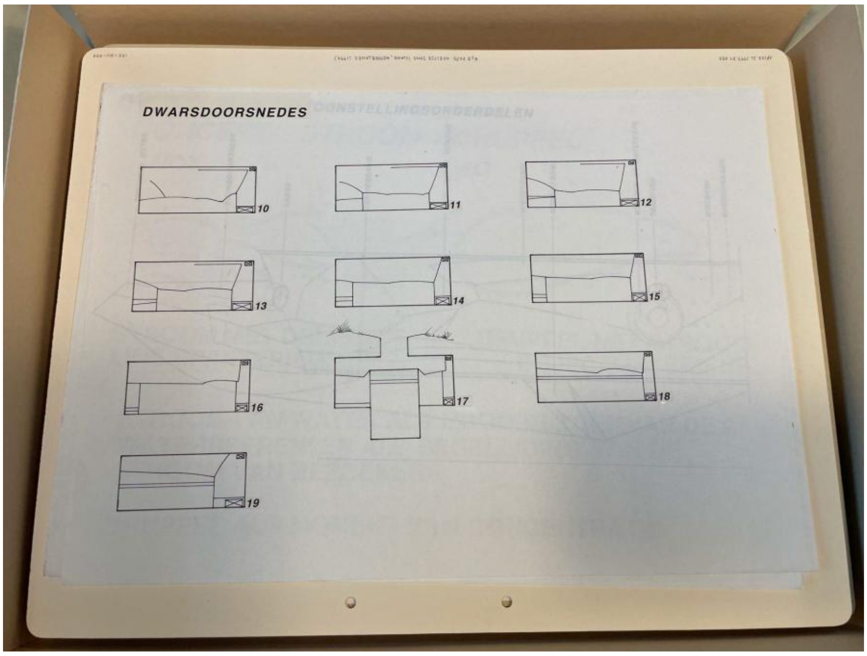

Figure 3. Serial transverse sections 10-19, Water Pavilion (freshH2Oexpo), 1993. Printed drawing with hand annotations. AP173 CCA collection. The second half of the section series covers the exhibition space and the central well area, where the elliptical profile reaches its widest horizontal orientation.

2.3 The Systems Diagrams: Programme as Parameter

The schematic representations in the AP173 CCA collection make up a different genre of drawings than the sections. While the latter describe geometric properties, the former describe relational properties—the dependence of programme on circulation and spatial sequencing that was supposed to be preserved throughout further designs.

An exemplary diagram is “Tentoonstelling”. The diagram, drawn in red ink above a schematic outline of the floor plan, describes the placement of twelve numbered programme items into the floor plan: bron, ijs, waterfilm, waterspiegel, pompen, put, verdoering, afvalwater, peilbeheer, waterloop, waterplassen, and waterstroming. Numbers create a sequential order, thus imposing a logical sequence of elements, regardless of the particular geometry of the sections. A visitor who enters at element number 1 and exits at number 12 would see a sequence from natural water phenomena to artificial water systems. This sequence is represented by the diagram via a set of rules regarding the spatial location of elements.

Another example is the “Watersystem” diagram, which uses a similar floor plan outline together with colored arrows indicating the direction of water flows in the building’s technical systems. Red arrows show the flow of fresh water through the system, while blue arrows indicate electric circulation directions. The diagram does not perform as a conventional mechanical drawing, because it does not give any information about diameters or equipment locations. Instead, the diagram provides topological information on which elements in the system are connected and the direction of the flows between them.

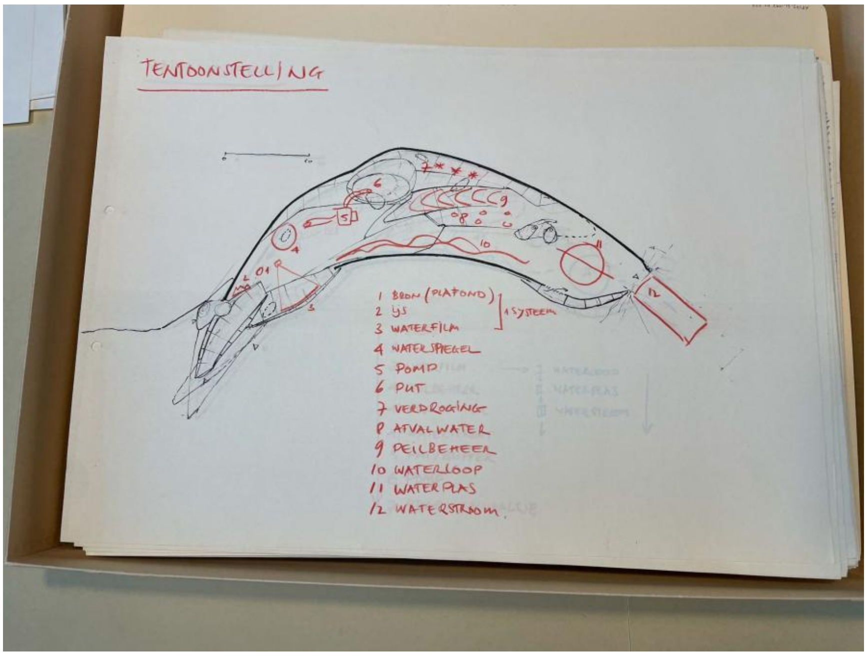

Figure 4. Exhibition programme diagram ("Tentoonstelling"), Water Pavilion (freshH2Oexpo), 1993. Hand-drawn in red ink on plan base. AP173 collection. Twelve programmatic elements are numbered and located within the plan outline, with flow directions indicated. The diagram encodes spatial sequence as a set of positional and directional rules.

2.4 The Heights Diagram: Ground Level as Parametric Variable

Perhaps one of the most analytically revealing documents in the AP173 collection would be the heights diagram (Hoogtes). Done in blue pencil upon the schematic plan, it shows the elevation of the ground surface at each significant place within the building as measured relatively to some base in approximate values. Ranging from around 140 centimetres as its maximum value to 400 centimetres as it is at the building's entrance, this diagram tracks the changes in the floor level throughout the building, which is its distinguishing feature.

In the case of a building with a horizontal floor, the level of the ground is defined. In the Water Pavilion, it is a variable—a parameter that varies continuously and must be taken into account with respect to structural sections and programmatic requirements alike. For example, a visitor standing in section 7 stands on the floor at a certain elevation above the structural shell and at a certain gradient relative to other sections. This relationship should be accounted for while designing. The heights diagram is the medium that enables these relations to be drawn and preserved.

The importance of the document under discussion emerges clearly from comparing it with the explanation of the design process that Spuybroek gave in the article. According to him, "renegotiating of the ground level within the building itself"[8] was among the last steps in the design process. The heights diagram is what shows that very negotiation—a sketch that reflects not the state of the design but the result of the parametric solution to the problem, the value of the variable at every point being determined by constraint satisfaction involving several subsystems simultaneously.

In turn, the series of sections, systems diagrams, and heights diagram together form a sketch system with each type of document responsible for particular aspects of parametric control. The sections are responsible for geometry; the programme diagram is responsible for the arrangement of spaces; the water system diagram is responsible for topological connections; and the heights diagram is responsible for the structural relationship with the ground. No one of them is superfluous since all of them refer to different aspects of the

[8] On the relationship between drawing systems and geometric continuity in architectural practice, see Robin Evans, *The Projective Cast: Architecture and Its Three Geometries* (Cambridge, MA: MIT Press, 1995), 352-380.

design problem. The sketch system as such may be considered the parametric model of the building.

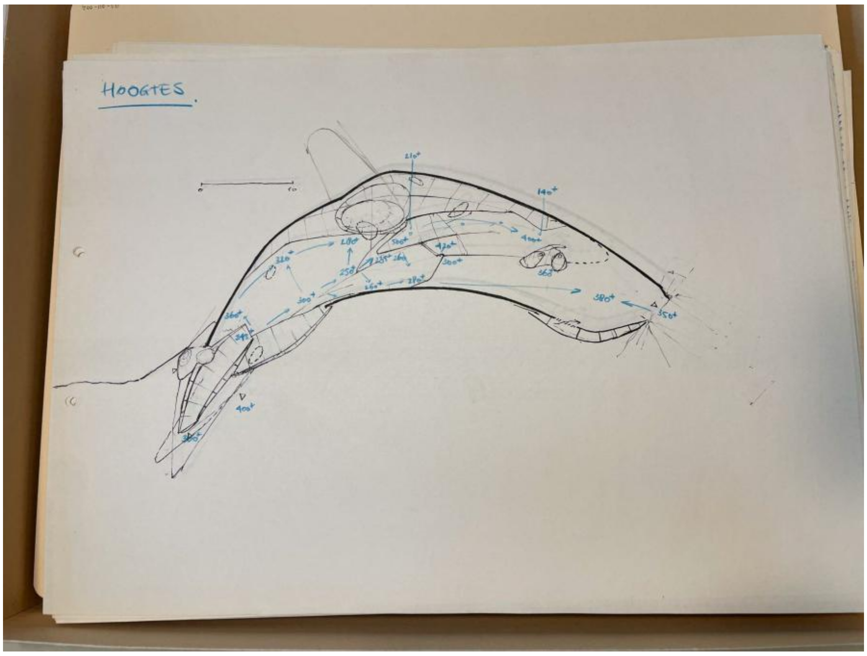

Figure 5. Heights annotation diagram ("Hoogtes"), Water Pavilion (freshH2Oexpo), 1993. Hand-drawn in blue pencil on plan base. AP173 collection. Ground level elevations are recorded at each significant position along the building, ranging from approximately 140 cm to 400 cm above datum. The diagram coordinates the variable floor level with the structural section series.

CHAPTER 3: FROM DRAWING TO BUILDING - TRANSLATION, AUTHORITY, AND CONSTRUCTION

3.1 The Drawing as Legal and Technical Authority

The changeover in the Water Pavilion project from drawing to building was not an act of approximation. As Spuybroek argues, it involved meticulousness up to millimeters: "Seriously, everything fitted on the millimetre, also because we drew the whole thing to the last detail." However, this contradicts a common idea about organic and topological architecture that states that complicated forms imply a tolerance toward onsite changes when trying to match initial ideas with construction materials. In case of the Water Pavilion, such tolerance was unnecessary since the drawings were precise enough to ensure the exact form of the pavilion.

Such precision was connected to the authority associated with the drawings. This idea is clearly expressed in Spuybroek's interview: "At that point drawings gave you pure authority, there was simply no way for the contractor to start introducing their own, cheaper solutions. Like in the Gothic or Baroque the rule was: we can only build what is first drawn." Mentioning of Gothic and Baroque architectural traditions shows how Spuybroek analyses the architecture project. In both cases, drawing had a purpose of binding specification of what the building should look like. [9]

Drawing of the Water Pavilion included sections with millimeter precision and coordinates of each structure element. Steel contractor obtained sections and information about each structural node with XYZ coordinates. General contractor was provided with coordinates for each concrete element. Drawing did not suggest some kind of ideal form for approximative realization. Instead, it specified geometry that the contractor had to follow.

3.2 The Coordinate System: Bridging 2D Drawing and 3D Construction

However, the on-site management of three-dimensional geometry was made possible with the help of another technology that appears almost as an aside in the course of the interview – the Total Station. "Just before, the contractor had purchased a Total Station where all data was entered and guided a laser on site." The Total Station is a surveying instrument combining the features of both the electronic distance measurement and the angle measurement instruments. Thus, a single person using a Total Station is able to obtain the exact coordinates of any point in three-dimensional space measured with millimetre accuracy from one stationary point. [10]

Although not parametric per se, the Total Station became an integral part of transferring the parametric principle used for the drawings into reality within the Water Pavilion Project. The link between the drawings and the data collected with the Total Station reveals the project's complex coordinate system. The geometry was first created as section drawings, and the resulting XYZ coordinates were transferred to the Total Station. Next, on site, the trusses that determined the position of those sections were precisely placed with the help of the Total Station and its laser. Ruled surfaces were obtained as a result of stretching steel C-profiles between the positions of the trusses. While there were no drawings showing the geometries of ruled surfaces, they came as a logical consequence of section drawings.

Construction photos of the pavilion allow seeing that difference between the drawn geometry and actual construction on site. In his interview, Spuybroek comments on the problem saying that "All 280 secondary beams are torquing, sometimes up to 50 degrees." The reason why they were torquing was not found in any drawing. It resulted from the fact

[9] Spuybroek, *NOX*, 18.

[10] Spuybroek, interview by author, March 3, 2025.

that connecting two different section curves resulted in obtaining a rotation surface executed by the steel C-profiles. [11]

Figure 6. Steel frame under construction, Water Pavilion (freshH2Oexpo), Neeltje Jans, 1997. Photograph. Lars Spuybroek, NOX: Machining Architecture (London: Thames & Hudson, 2004), 23. The torquing of the secondary C-profile beams - visible as the diagonal twist in the secondary structure - was not drawn but emerged from the relationship between adjacent section curves.

3.3 Material Constraint as Parametric Input

Among the surprising characteristics of the construction process identified through archive research and interviews is the extent to which physical constraints served as parametric inputs, rather than obstacles. The prime example of this phenomenon relates to the curvature of the section. Since AutoCAD 11 could represent ellipses only through a chain of circular arcs, all section curves of the pavilion are approximations of ellipses. Moreover, since steel-rolling machines worked using circular arcs, such an approximation was not an obstacle in any way, but rather a material specification: a drawing represented a precise instruction for the machines.

Another example can be found in relation to the concrete structure. As mentioned earlier, the concrete slab of the pavilion together with its retaining walls are completely hidden behind its metal facade; it is "a roof on the ground," as Spuybroek puts it. Coordinates for placing the concrete were provided by the design office, allowing the general contractor to

[11] Spuybroek, *NOX*, 22-23.

use conventional surveying techniques in spite of the unconventional shape of the structure. Complexity of the geometry was condensed into XYZ coordinates, and no knowledge of the S-curve geometry was required of the contractor.

These two cases show how one can obtain a more complex image of the relationship between drawing and building than the simple story told in the discourse of digital architecture allows. Drawings of the pavilion were not simply recording a design and transmitting it to the construction site. Instead, they were absorbing material and technical specifications—the rolling machines limitations, surveying equipment capabilities, conventions of a concrete contractor—and encoding them in the geometry of the object. [12]

3.4 The Limits of Drawing-Based Control

While the meticulousness in the creation of the Water Pavilion proves that there are no limitations to the drawing system, an interview with Spuybroek reveals the one area where these limitations existed. According to Spuybroek, "I worked with a separate group on the interactive systems." By this statement, he means the sensors, projectors, and sound equipment, which formed the interactive interior of the Water Pavilion. The coordination of these interactive electronic systems was done verbally and through overlaying them on the architectural drawings and not within the integrated drawing system. [13]

It is quite enlightening to note that the architectural drawings controlled the geometry and the program of the pavilion. On the other hand, the technical systems were superimposed on this control. While the parametric logic of the drawing system was applicable in defining both structural and spatial parameters, it did not extend into the realm of the interactive systems. It is for this reason that the parameter set created by the drawing system had a boundary, and this boundary coincided with the demarcation of the two areas of expertise.

CHAPTER 4: DRAWING INTELLIGENCE AND THE PARAMETRIC TURN

In the ten-year interval leading up to the construction of the pavilion, the Water Pavilion experienced a marked change, as the context that required its drawing method changed

[12] Ibid., 23.

[13] Spuybroek, interview by author, March 3, 2025.

significantly. Associative parametric software, namely Catia and then Grasshopper, became available in architectural practice. With it came the first possibility to encode geometrical rules into a model; a change in one part of the model would cascade through the rest of it automatically. The dispersed intelligence in the hand-managed drawings of Spuybroek and his collaborators could now be concentrated into one computational model.

There is the temptation to read the development of a parametric approach into a simplistic story of progression – namely, the progression from drawing to parametric software. However, in his retrospective analysis of the relation between drawing-based parametricism and parametricism proper, Spuybroek states: "I don't think we'd want fully associative software, that's always been the problem of parametricism: it understands everything as 'continuous variation' but gradual changes are organised by hard thresholds." The drawing-based method of the Water Pavilion was neither about continuous variation nor about parametric modeling: the building was managed through a series of discrete decisions, where each individual section was one unique geometric operation, each individual diagram one specific relational rule – all this based on the architect's active understanding of the building as a unified whole. [14]

While the distinction between continuous variation and discrete decision points might appear to be purely technical, it points towards a fundamental divergence in parametric architectural design philosophies. The dominant one sees parametricism as a tool to generate variation, an automatic process where the input can produce a wide range of different shapes. On the other hand, the drawing-based design process involved something else entirely: not an attempt to produce a range of different models but a translation of one specific form into a built structure. The drawings in question did not generate variation – they regulated a specific relationship that was defined by the architect beforehand and transmitted that relationship to the builder in such a way that it could not be misinterpreted. [15]

According to Oxman, there is more to the change from a drawing-based to a software-based approach to design than just a new set of tools: in the former, the design intelligence is distributed over multiple documents; in the latter, it is concentrated into one document, in which consistent relationships are guaranteed automatically. In the case at hand, a drawing-based solution was brought to its limit: an extremely complex project with a highly intricate geometric design needed a careful management through an elaborate drawing system, with

[14] Mario Carpo, *The Alphabet and the Algorithm* (Cambridge, MA: MIT Press, 2011), 98-112, develops the broader argument that digital tools transformed the relationship between design notation and material execution.

[15] Spuybroek, interview by author, March 3, 2025.

its particular intelligence of managing relations through the architect's active understanding – all of which had to give way to computational parametricism. [16]

Consequently, the Water Pavilion shows not just how the idea of parametric thinking preceded the advent of parametric software but also demonstrates the difference between a drawing-based and a computational parametricist approach to architectural design. These differences should not be understood in terms of efficiency, as drawing-based parametricism was no less capable of solving a difficult geometric problem than parametricism was – rather, they are based in the distinct design knowledge practices.

CONCLUSION

First, this thesis proposes that NOX's drawings for the Water Pavilion, created between 1993 and 1997, worked as parametric controls for the building in the absence of parametric software. The section series, systems diagrams, and the heights diagram together represented the parameter set for the Water Pavilion's geometry, program, and construction, since the lack of associative software implied that the rule set had to be manually applied through drawing techniques and documentations. The rules, as opposed to their results, constituted the real content of NOX's design. This is why these drawings can be considered as the parameter model.

Archival evidence corroborates that claim in a number of ways. For example, the nineteen numbered transverse sections encoded the geometric transformation of an ellipse into the ruled surface, providing precise information about every structural element of the pavilion. The systems diagrams coded the relationship between programs and circulation, while the heights annotation charted a variable connection between the structural envelope and the ground level. Overall, the documents show that the parametric logic of the pavilion is embedded not in software but in the drawing system.

Similarly, construction evidence collected through the interview with Spuybroek illustrates that the drawing system carried authoritative power in a strong sense. The contractor could only build that which was previously drawn. Total Station transformed the coordinate data in the drawings into precise three-dimensional points in the site. Constructional constraints, including material limitations of the concrete rolling machine and working standards of the contractor, were accounted for in drawing geometries, thus avoiding further site-related

[16] Picon, *Digital Culture in Architecture*, 62-75.

decisions. It should be noted that the drawing system was not a representation of the water pavilion but the tool for its technical and legal creation.

Overall, the importance of this interpretation is rooted in its broader historical context. Specifically, the current discourse views the history of parametric architecture exclusively through the lens of the computational software, i.e., Grasshopper. The Water Pavilion presents an opportunity for an alternative framing that sees the origins of parametric design outside of computation. More specifically, parametric reasoning—a set of variable relations between architectural elements—existed even before Grasshopper, and could be seen in drawings of architects pushing the limits of early digital software. Retrieving this history through the archival data, such as the AP173 collection, is not only necessary for the historical account's completeness but a way to recover the displaced intelligence.

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