THE WORKING DRAWING

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THE WORKING DRAWING

THE ARCHITECT'S TOOL

EDITED BY ANNETTE SPIRO AND DAVID GANZONI
CONTENTS

Annette Spiro

THE WORKING DRAWING, AN ALPHABET OF ITS OWN

P. 6

A-M PLAN COLLECTION

ARRANGED IN 12 CHAPTERS
TEXTS BY ANNETTE SPIRO

A BUILDING MANUAL P. 8

B BUILDING PROCESS P. 28

C MATERIAL P. 44

D BUILDING ELEMENTS P. 72

E HIDDEN STRUCTURE P. 102

F TOOLS P. 126

G MEASUREMENT AND NUMBERS P. 144

H NUMERALS AND SYMBOLS P. 160

J CATALOGUE P. 178

K DISTANCE P. 198

L SPACE P. 218

M USER P. 244
CONTENTS

I-XII

ESSAYS

I
David Ganzoni
ARCHIVE OF THE WORKING PROCESS
Means of communication between drawing table and building site
P. 264

II
Hermann Czech
PLAN AND IMAGE
Possible roles in the design process
P. 267

III
Philip Ursprung
THE WORK OF THE ARCHITECT
Peter Zumthor's working drawings
P. 270

IV
Tom Emerson
LINES ON PAPER
The enduring language of architecture
P. 273

V
Jonathan Sergison
WORKING/DRAWING
The tension between hand and computer drawing
P. 276

VI
Mario Carpo
CRAFTSMAN TO DRAFTSMAN
The Albertian paradigm and the modern invention of construction drawings
P. 278

VII
Stephan Rutishauser
FUTURE PLANS
From visual representation to digital code
P. 281

VIII
Uta Hassler,
Daniel Stockhammer
ON THE DEVELOPMENT OF THE BUILDING PLAN
Knowledge transfer, demonstration of ideas, or instructions for building?
Automation of the drawing technique and copy method in plan production around 1900
P. 284

IX
Urs Primas
CONTEMPORARY WITNESSES
The implementation plans for Sustenstrasse
P. 294

X
Kornel Ringli
PLANNED MYTH
The building plans for Eero Saarinen's TWA terminal as marketing tool
P. 298

XI
Ákos Moravánszky
THE AXONOMETRIC PLAN
On the objectivity of the architectural drawing
P. 301

XII
Philipp Esch
VIEWED FROM A STEP BACK
Possibilities for representation
P. 306

CHRONOLOGY
P. 310

APPENDIX
P. 312
One hundred working drawings are gathered in this book. But even for a small structure, one hundred drawings would be very few. For the renovation of the Palacio San Telmo in Seville alone, 787 working drawings were created; among them, a garden plan, which is included in this book. With a hundred building plans, it might be possible to build a small house.

If the builders of the Tower of Babel had had working drawings available back then, maybe the tower would have risen to the heavens, since like language, the plan, too, is a means for understanding. A drawing is more universal than words and letters. The “handwriting” of the working drawing has changed less over the centuries than the style of handwriting of the alphabet. Moreover, the drawings are understood across cultural and linguistic borders. The carpenter working on Gion A. Caminada’s house in Val Lumnezia would be able to build based on the plan by Studio Mumbai in this book, despite the Indian writing! After all, who is capable of effortlessly reading a Middle High German text in old-face type? In contrast, on the basis of the oldest plan in this book we could still build the Cologne Cathedral.

Every architect knows the hour of truth, when the working drawing is prepared. Countless sketches and plans have accompanied the design process. Step by step, decisions have been made and project plans redrawn and newly drawn. The true acid test, however, is the working drawing; the building plan. Every stroke counts, every screw has to be in the right place, every specification is binding. Once the building plan is drawn, all of the hitherto sketches and plans become obsolete in a single stroke. They are outdated, worthless, and even become disruptive, as Hermann Czech describes in his contribution. Nonetheless, the working drawing’s survival is often assured only until the end of the compulsory record-keeping period, unlike project sketches, which wait, full of hope, for later historians. For that very reason we gathered working drawings from the silent archives, from old plan cases, and the depths of hard drives. We selected building plans, not buildings. The subject of this book is the building plan and its depiction.

The working drawing is a technical tool: factual, binding, and precise. It does not veil or embellish anything; it is not meant to be interpreted,
FOREWORD

but instead, clearly read. The symbolic language it uses must hold to norms and conventions. And nonetheless—or perhaps for that very reason?—it is an unrivaled means of expression bearing the architect's handwriting. "A poem is composed of words, not emotions," said the poet Stéphane Mallarmé. That also applies to architecture, and precisely this is what the working drawing reflects, more clearly and beautifully than anything else. The one-hundred plans in this book should suffice as evidence.

How very much we would have liked to have shown one of the expertly drawn building plans by F. L. Wright; or Gustave Eiffel's construction plan of the framework hidden inside the Statue of Liberty. How gladly we would have received a building plan from the hand of Gio Ponti instead of the wonderful furnishing plan, which despite its beauty could not be smuggled in under the theme of working drawings. Our treasure hunts were not always crowned with success. Archives and foundations were closed or not yet reopened, estates neglected or even destroyed, and alleged working drawings turned out to be retrospectively drawn "fakes." But on the other hand, we also stumbled upon unexpected finds, plans whose existence we had hitherto not suspected, and well-known objects that revealed new, surprising faces in their working drawings. Our forays through archives turned out to be journeys through time. We chose one hundred plans and organized this selection in twelve chapters. The order is subjective. In one case, the chapter takes "purpose" as theme, in another, the depiction of the plans. There is an intention in the order, but no compulsion. Those who prefer things in systematic form will find all of the plans in proportionally reduced size, chronologically arranged at the end of the book. We would have gladly shown the plans in their original size, but the book format imposes borders on the plans' reproductions. The largest plan in this book is eight times smaller than the original. The reader has to pick up a magnifying glass to recognize the pinnacles and gargoyles on the façade of the Cologne Cathedral. In return, the plan excerpts in the capital overviews show original size pencil strokes and stroke strengths from every drawing. The present book removes the plan from its usual context, even from the object. Every drawing stands on its own and can be viewed up close: Or from a distance, with squinted eyes, as Philipp Esch describes the unbiased view of the "naïve" beholder in his text.

The practicing architects who have written for this book will have drawn a sound number of plans in their lives as architects and know only too precisely the matter at hand; the architectural historians and architects who research construction recognize the handwriting of a draftsperson from Antonio da Sangallo's workshop and know which colors the architect in the eighteenth century had in his watercolor box. It is often difficult to follow the tracks of a plan. Uta Hassler and Daniel Stockhammer write in their contribution: "... It is extremely rare to find documentation of design efforts or a working drawing preserved in any of the famous plan collections." The twelve texts in this book demonstrate—like the plan itself—that the border between theory and practice, between science and art is blurry in our profession and the authors themselves straddle the disciplines.

In contrast to the plans of days gone by, the most recent plans in this book are no longer so easy to read, as they are not drawn, but written. Will they one day be seen as special features in the history of the working drawing? Or are the scripts harbingers of an architectural practice without working drawings? Perhaps we are at the end of a long history of the working drawing. Should this be the case, then this book might already soon be read as a nostalgic look at a past drawing culture. But it is too early for a swan song, and the gratification of a beautiful building plan remains untrammelled: the main aim of our book is to arouse this pleasure.
BUILDING MANUAL
The plan for the Simpson-Lee House by Glenn Murcutt is densely written. The sectional plan is both a working drawing and a specification of its parts. Murcutt's working drawing is directed toward the all-round craftsman who must construct an entire house in the remote wilderness. Jean Prouvé also draws practical instructions for construction. "You all know how a building site works: first of all, the project, the planning, which is fragmentary... then, the foundation; and after that, you get together the building material: stone, concrete, you build up slowly, and with effort, a single-family house can be put up within a year. For that, you have to get hold of an amount of material that would almost make you shudder" (Jean Prouvé, 1946). His building plan is the answer to the drain on time and material of the building tradition at the time. His working drawings are assembly instructions as he is not only interested in the end product, but also in the building process. The sales brochure for the prefab vacation home announces: "within hours." Prouvé measures the time required for putting up or taking down the house in hours! Time is just as valuable as material. It has to be fast so that the exhausted worker can enjoy the weekend. Even the plan depiction attests to economy and efficiency. Section, scheme, perspective, axonometric drawing, every part of the house is depicted as efficiently as possible; the plan has almost no white areas. Material is valuable, even paper for the plan. The perspective drawings is practical and efficient, as shown by Frei + Saarinen's drawing for the Xenix-Bar, as well as the building note-books by Studio Mumbai. Bijoy Jain draws his building plans by hand with a red felt-tip pen on graph paper. They are evidence of a different understanding of building: the building site is the architect's office. Together with the craftsmen, he develops the building directly on site. The contrast to Prouvé's efficient building process could not be any greater.

The working drawing for a pavilion roof in the reciprocal framework method is a proper set of assembly instructions. The working drawing is a text. One line for every roof lathe: rod number, number of the attached rods, length and division of the drill holes, as these are symmetrical. No more is necessary. The drawing on the right side of the plan is there only for the uninitiated, to form a picture of the finished structure. Afterward, the whole thing is like a puzzle: every building element has a number, they simply have to be put together lathe by lathe.

The more precise the building plan is, the less time the architect has to spend on the building site. Or at least in theory! Bogdan Bogdanović sees himself in the tradition of the medieval master builder. His plans are not precise building instructions, but instead, hand-drawn sketches. That is what he takes to the building site; for him, designing and building are one and the same. Le Corbusier's colored drawings, too, are building manuals. The young Alfred Roth drew the axonometric depictions and sent them to the master in Paris to "paint in." What came back were little color samples, mixed with gouache, painted on the back of wallpaper. The sample is still the best method for clearly representing the color shade.
A1

JEAN PROUVE
P. 13

Paper format: 100 x 71cm
Drawing technique: Pencil and colored pencil on tracing paper
Scale: 1:1, 1:5, 1:10
Plan contents: Floor plan, sectional views and perspectives: details
Date: 3 July 1939
Drafted by: Jean Boutemain
Object: Holiday residence
Location: Onville, France
Time of construction: 1939

A2

GLENN MURCUTT
P. 15

Paper format: 59.4 x 42cm
Drawing technique: Ink on plastic film
Scale: 1:20
Plan contents: Cross section
Date: September 1989
Drafted by: Glenn Murcutt
Object: Simpson-Lee House
Location: Mount Wilson, Blue Mountains, New South Wales, Australia
Time of construction: 1988-1993

A3

BARBARA FREI, MARTIN SAARINEN
P. 17

Paper format: 42 x 29.7cm
Drawing technique: Pencil on paper
Plan contents: Perspectives of cabinetry works
Date: 2007
Drafted by: Martin Saarinen
Object: Xenix Bar
Location: Zurich, Switzerland
Time of construction: 2006-2007

A4

BIJOY JAIN, STUDIO MUMBAI
P. 19

Paper format: 14.8 x 21cm
Drawing technique: Red pen on gridded drawing paper, heading stamp
Plan contents: Sectional and axonometric views: master bathroom partition detail, master bathroom detail
Date: 6 July 2011 / 5 February 2011
Drafted by: Punaram Suthar
Object: Copper House II
Location: Chondi, Maharashtra, India
Time of construction: 2011
A6
BOGDAN
BOGDANOVIC
P. 23

42 x 29.7 cm
CAD
Assembly and mounting instructions
11 February 2011
Udo Thonnissen
Fulcrum bracket mount, ETH Honggerberg
Zurich, Switzerland
April 2011
Professor Spiro, ETH Zurich
Marc Blaser, Pascal Hendrickx, Christopher Rofe

42 x 29.7 cm
CAD
Assembly and mounting instructions
11 February 2011
Udo Thonnissen
Fulcrum bracket mount, ETH Honggerberg
Zurich, Switzerland
April 2011
Professor Spiro, ETH Zurich
Marc Blaser, Pascal Hendrickx, Christopher Rofe

69 x 69 cm
Pencil on paper
Layout sketches
Bogdan Bogdanovic
Adonis altar for the International Sculpture Park
Labin, Croatia
1973–1974

71.7 x 51.3 cm / 24.4 x 27.5 cm
Pencil and oil pastels on tracing paper, Lettering in ink / color pattern glued to paper
1:100 / no scale
Axonometric: color concept / color pattern
Alfred Roth, Le Corbusier (not signed)
Werkbundsiedlung Weissenhof
Stuttgart, Germany
1927

71.7 x 51.3 cm / 24.4 x 27.5 cm
Pencil and oil pastels on tracing paper, Lettering in ink / color pattern glued to paper
1:100 / no scale
Axonometric: color concept / color pattern
Alfred Roth, Le Corbusier (not signed)
Werkbundsiedlung Weissenhof
Stuttgart, Germany
1927

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Coupe a-b

Camp de Vacances d'Orvillé

Abri démontable
Portiques

Schéma de montage

68 30

op: 2200

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DET. A

Plan Balkenaufänger für abgelängte Dachecke folgt.

DET. B

Nut wie bis A 15MM tief 10 MM hoch bis Rahmen

ACHTUNG
Anpassung Rohbauwand nötig für Fussleiste

entfernen

Schräge unten parallel zu Schalung

Ecke verleimt und Grundris
ACHTUNG:
Anpassung am Rohbauwand nötig.

15MM

ACHTUNG!
Anpassung am Rohbauwand und Fensterlaibung nötig.
Bar-abgewandte Seite kann zu Verst. aufgedoppelt werden, da unsichtbar.
stabquerschnitt: 0.024 x 0.048m
teilungsproportion: 0.33
uerberlaenge u: 0.10m
exzentritzaeta e: 0.05m

stab 0: 5, 2, 35, 32, laenge: 1.23 teilung: 0.34
stab 1: 4, 5, 18, 88, laenge: 1.61 teilung: 0.47
stab 2: 0, 3, 32, 17, laenge: 1.07 teilung: 0.29
stab 3: 2, 4, x, laenge: 1.72 teilung: 0.52
stab 4: 3, 1, x, laenge: 1.23 teilung: 0.36
stab 5: 1, 0, 88, 35, laenge: 1.72 teilung: 0.51
stab 6: 8, 11, 130, 14, laenge: 0.91 teilung: 0.24
stab 7: 10, 9, 12, 147, laenge: 1.39 teilung: 0.4
stab 8: 9, 6, 131, 130, laenge: 0.93 teilung: 0.24
stab 9: 7, 8, 147, 131, laenge: 1.36 teilung: 0.39
stab 10: 11, 7, x, laenge: 0.78 teilung: 0.21
stab 11: 6, 10, x, laenge: 1.1 teilung: 0.32
stab 12: x, 183, 7, laenge: 1.42 teilung: 0.42
stab 13: x, 16, 183, laenge: 1.39 teilung: 0.41
stab 14: x, 6, 125, laenge: 1.19 teilung: 0.35
stab 15: x, 125, 19, laenge: 0.89 teilung: 0.25
stab 16: x, 133, 13, laenge: 1.09 teilung: 0.31
stab 17: x, 2, 133, laenge: 1.76 teilung: 0.54
stab 18: x, 89, 1, laenge: 1.68 teilung: 0.51
stab 19: x, 15, 89, laenge: 1.47 teilung: 0.44
stab 20: 30, 21, 75, 81, laenge: 1.44 teilung: 0.41
stab 21: 20, 22, 81, 85, laenge: 1.91 teilung: 0.57
stab 22: 21, 24, 85, 101, laenge: 2.37 teilung: 0.72
stab 23: 24, 25, 108, 111, laenge: 2.15 teilung: 0.65
stab 24: 22, 23, 101, 108, laenge: 2.31 teilung: 0.7
stab 25: 23, 27, 111, 58, laenge: 1.87 teilung: 0.56
stab 26: 27, 28, 57, 55, laenge: 1.99 teilung: 0.6
stab 27: 25, 26, 58, 57, laenge: 1.58 teilung: 0.46
stab 237: x, 141, 236, laenge: 1.69 teilung: 0.51
stab 238: x, 234, 128, laenge: 0.86 teilung: 0.24
stab 239: 240, 213, 243, 210, laenge: 1.36 teilung: 0.39
stab 240: 230, 239, 229, 243, laenge: 1.32 teilung: 0.37
stab 241: 208, 231, 209, 214, laenge: 2.01 teilung: 0.6
stab 242: 243, 224, 247, 226, laenge: 1.05 teilung: 0.28
stab 243: 239, 242, 240, 247, laenge: 1.23 teilung: 0.34
stab 244: 245, 159, 248, 156, laenge: 1.21 teilung: 0.34
stab 245: 225, 244, 226, 248, laenge: 1.18 teilung: 0.33
stab 246: 228, 247, 227, 248, laenge: 1.2 teilung: 0.33
stab 247: 246, 243, 248, 242, laenge: 1.32 teilung: 0.37
stab 248: 244, 246, 245, 247, laenge: 1.0 teilung: 0.27
stab 249: 235, 150, 236, 151, laenge: 0.9 teilung: 0.23

anzahl staebe: 250
laenge gesamt: 352.78 m

stab nr: EP1, CP1, CP2, EP2, laenge. teilungsmass a

Montage | Fertigung
Eclairer une tete
Terre et selles oudes
Miel et colle de peau
Ou deux

Terre et sels d'inter + sel
Terre et sels d'inter + sel
Terre et sels d'inter + sel

Préparation
Miel et colle

Terre et selles brûlable
Puis couver avec du papier
Ou peinture

Attention
Ou l'oeil
Ses mitus colors
Prendre soin de
acton bien
BUILDING PROCESS
Building is a sequence of individual work stages precisely tuned with one another. The working drawing, on the contrary, records a finished state; it shows how the building parts are put together. How can the course of time be captured on a working drawing?

The classical time plan is from Max Bill. The grid of the days and weeks is not drawn on practical "graph paper," but instead, meticulously brought to paper by hand with different stroke strengths. The indications of the work genres are abbreviated to fit precisely into the small columns. The thick, two-colored strokes are not, for example, a tribute to a work of Concrete art. The black strokes on the blue prints show the planned course of construction; the subsequently added red ones, the actual course of events. The construction site of the new University of Applied Sciences and Arts Northwestern Switzerland in Muttenz is a great deal larger than this little house. The preparation of the building lot alone demanded complex step-by-step planning to keep the movement of earth to a minimum.

Two masonry plans represent the same building principle yet are hardly comparable. Alfred Friedrich Bluntschli’s stacking plan shows how the church tower rises up stone for stone, layer for layer. Every stone layer is depicted separately and every stone is furnished with a number. How sparingly the architect was with the building material is shown by the small note in the margins: "The pieces that have become disposable through the elimination of the layers LXXXVII–XCIV from earlier drawings, should be made use of if possible..." Also in the masonry plan by Gramazio & Kohler, every stone layer is drawn individually. But no mason can read the plan. The addressee is a machine. No stone is centered, no joint set somewhat broader, as the robot does not have a sense of proportion. Instead, it places every stone in its place precisely to the millimeter. The working drawing is a "script"; the robot’s "hand" and "bricklayer's trowel" are controlled directly by the programming.

It is no coincidence that two landscape architects can be found in this chapter of building plans. While the course of time is decisive for the construction in the building of a house, in the garden it is ubiquitous. The garden is never finished and in every season it is different. Gustav Ammann draws the same rose garden in three phases: tulips, pansies, and roses. He designs an individual color canon for each flowering. In contrast to the rich gouache of Burle Marx’s tropical plant world, Gustav Ammann draws his plans with delicate colored pen strokes as though aiming to capture the transiency of seasons and blossoms. The drawings from Fred Eicher’s workshop are entirely different. The shrubs and bushes are densely "woven" with abstract lines: a garden in the thick greenery of a summer’s day. In the drawing, the beholder can simply imagine the impatience until the desired state is achieved and the trees are fully grown.
Bl-

Paper format: 42 x 27.5 cm
Drawing technique: Watercolor on heliography
Plan contents: Time schedule
Date: 27 April 1933
Drafted by: Robert Winkler
Object: Haus Bill
Location: Zürich, Switzerland
Time of construction: 1932-1933

Paper format: 52.2 x 72 cm
Drawing technique: Ink and colored pencil on tracing paper, lettering in black, red, and blue ink, stamp
Scale: 1:50
Plan contents: Floor plan: stone layers
Date: 8 March 1993
Object: Protestant Church Enge
Location: Zürich, Switzerland
Time of construction: 1892-1894

Value = $stoneDepth + $vertGap;
tMod = sin($j*$pi/$waveLength)*cos($j2+$j);
if ($j2+$j == 0)
{
polyCube -w $stoneWidth -r $wa 0 0 90;
move -r (-($offset*$move);
polyCube -w $stoneWidth -h $stoneH
rotate -r $wa 0 0 90;
move -r ($offset*$move);
rotate -r $wa 0 0 ($rotateMax*$rotate);
polyCube -w $stoneWidth -h $stoneH
rotate -r $wa 0 0 90;
move -r ($moveValue*$j) 0 ($short

Drawing technique: Maya Embedded Language MEL
Plan contents: Production code for robotic production of a non-standard brick wall
Date: 15 February 2006
Drafted by: Silvan Oesterle, Michael Knauss
Object: Curtain, wall, brick wall
Location: Zürich, Switzerland
Time of construction: February 2006
Plan author: Gramazio & Kohler, ETH Zürich
Paper format: 59.4 x 37 cm / 63.6 x 40.9 cm / 64.8 x 35.4 cm
Drawing technique: Pencil and colored pencil on sketch paper
Scale: 1:100
Plan contents: Floor plan; colors of the tulips, pansies, roses
Drafted by: Gustav Ammann (not signed)
Object: Swiss National Exhibition 1939, Rose Garden
Location: Zurich, Switzerland
Time of construction: 1939

Paper format: 153.8 x 82.3 cm
Drawing format: 148 x 76 cm
Drawing technique: Ink on sketch paper
Scale: 1:100, 1:20
Plan contents: Site plan with longitudinal and cross sections
Date: May 1994
Drafted by: Hansjörg Jauch
Object: Sport Center Tüs
Location: Adliswil, Switzerland

Paper format: 147 x 60 cm
Drawing technique: CAD
Scale: 1:500
Plan contents: Site plan: phases of ground management
Date: 5 April 2013
Drafted by: Patrick Hann
Object: Fachhochschule Nordwestschweiz
Location: Muttenz, Switzerland
Time of construction: 2014-2018
Architect: Pool Architects
Die durch Wegfallen der Schichten XXX - XIV früherer Zeichnung Susonadel werdenenden Stücke sind nach Möglichkeit zu verwenden; ein Teil kann in der angegebenen Weise verwendet werden. - Die Kanten Raglen sind die früheren.
proc brickWall(int $x, int $z, float $stoneWidth, int $stoneHeight, 
    int $stoneDepth, float $vertGap, int $horizGap, 
    float $waveLength, float $rotation) 
{
    float $rotateMod;
    float $moveValue;
    float $offset = 0.25;
    float $rotateMax = $rotation*45.0;
    float $pi = 3.1415927;
    float $rotateReduction = 0.32;

    for($i=0; $i<$z; $i++) 
    {
        for($j=0; $j<$x; $j++) 
        {
            $moveValue = $stoneDepth+$vertGap;
            $rotateMod = sin($j*$pi/$waveLength)*cos($i*$pi/$waveLength);
            if($j%2==0) 
            {
                if($j==0) 
                {
                    polyCube -w $stoneWidth -h $stoneHeight -d $stoneDepth -ax 0 0 1;
                    rotate -r -ws 0 0 90;
                    move -r (($offset+$moveValue)+($moveValue*$j)) 0 (($horizGap+$stoneHeight)*$i);
                }
                polyCube -w $stoneWidth -h $stoneHeight -d $stoneDepth -ax 0 0 1;
                rotate -r -ws 0 0 90;
                move -r ((2*$offset+$moveValue)+($moveValue*$j)) 0 (($horizGap+$stoneHeight)*$i);
                rotate -r 0 0 ($rotateMax*$rotateMod);
            }
            else 
            {
                polyCube -w $stoneWidth -h $stoneHeight -d $stoneDepth -ax 0 0 1;
                rotate -r -ws 0 0 90;
                move -r ($moveValue*$j) 0 (($horizGap+$stoneHeight)*$i);
                rotate -r 0 0 ($rotateMax*$rotateMod);
            }
        }
    }
    $rotateMax -= $rotateReduction;
}

brickWall(17, 32, 240, 52, 10, 0, 48);
L.A. ROSENGARTEN FARBENPLAN FÜR TULPEN
MASST. 1:100
MATERIAL
When Sigurd Lewerentz draws masonry work, he "builds" the walls, as it were, with pencil on paper. One can positively smell the bricks. The graphite traces of the pencil strokes anticipate the smudged mortar of the broad joints. Each stone is drawn individually in the margins, at the center, a stroke is sufficient to indicate the bed joint. In Lewerentz's buildings there is no chipped stone, every brick is whole, even in the ascending wall finishes. The mason will take care not to place a single stone in the wrong place. The drawing shows the materiality of the bricks as well as the module principle with which one can build entire houses, even entire cities. Even the most skilled renderer must go to great efforts to achieve the material radiance of a masonry plan by Lewerentz.

Gion A. Caminada's house is drawn with sharpened pencils, in a traditional "Strickbau" or log house building method. Seamless chain dimensioning, tolerance for shrinkage and setting; a working drawing for the carpenter! Also on Hans Leužinger's building plan, the measuring lines are drawn with razor-sharp strokes, while the cross-sections of the wood lathes, on the contrary, are made with the broad side of a soft lead, almost like a wood frottage. The organically shaped roof by Severiano Mario Porto can be found in a clearing in the woods in the middle of Amazonia. He draws the roof truss as though he would lay, with the pencil stroke, every individual rafter on the beams. Mario Porto's working drawing records the experience of countless generations of forest dwellers.

The concrete stairway by Herzog & de Meuron is a single unit. Here, plasticity is the theme. The stairway is made of in-situ concrete, it cannot be easily poured from the top like a prefabricated flight of stairs. One "sees" the casting process in the building plan stroke for stroke. The drawing, as well as the course of construction, are demanding: The formwork should take place under the architect's supervision according to the remark in the plan header. On Luigi Snozzi's working drawing, there is a similar reference: "Esigenze da rispettare. New boards, same division, uniform panel direction." Exposed concrete pardons no error. Snozzi's drawing also exemplarily shows the most important thing—harmonizing the dimensions of the shell panel and building volume. In the working drawing by engineer Siguer Mitsutani, in contrast, the beholder sees the building through the eyes of the engineer, reduced to a single construction process: the body of a concrete ceiling. Spatial and load-bearing structures are one and the same in the residential block by the architect Paulo Mendes da Rocha.

For every building material, there is the appropriate drawing technique. It is no coincidence that the steel construction plans are drawn with inks and supplemented with axonometric drawings, as used also in civil and mechanical engineering. Oliver Schwarz's working drawing of a pavilion is one single axonometric depiction. The entire structure can be built with this one plan and an object list. The depiction fits with the character of steel construction. The forms are standardized and the drawings assembly instructions. The way that the parts are joined is relevant. The interfaces are also important on Franz Fueg's detail plan of the church façade, however, the draftsman can spare himself the repetition of the parts. Mirko Baum's working drawing contains the history of steel construction with its ingenious spirit of invention. His steel bridge is likewise a machine.

Caruso St John's floor plan is about stone. The houses remain white, only what is found under the soles of the feet is drawn on the plan. The stone floorings lie next to one another like roughly and finely woven carpets. In contrast to Lewerentz's masonry work, each stone is not drawn individually. Instead, similar to "pattern repeat" in the printing of textiles, the computer repeats the pattern, although the floorer still lays each stone by hand.
C1
SIGURD LEWERENTZ P.51

Paper format: 171.3 x 74.6 cm
Drawing technique: Pencil on tracing paper
Scale: 1:20
Plan contents: North façade
Date: 7 August 1965, revised 4 October 1965 and 6 February 1967
Drafted by: Sigurd Lewerentz
Object: St. Peter's Church
Location: Klippan, Sweden
Time of construction: 1965 – 1966

C2
GIONA CAMINADA P.53

Paper format: 84.1 x 59.4 cm
Drawing technique: Pencil on sketch paper
Scale: 1:20
Plan contents: Cross section
Date: 28 March 1996
Drafted by: Thomas Stettler
Object: Haus Caminada-Wellingen
Location: Vrin, Switzerland

C3
SIGUER MITSUTANI P.55

Paper format: 106.4 x 60.3 cm
Drawing format: 101 x 57.7 cm
Drawing technique: Ink on tracing paper
Scale: 1:50
Plan contents: Floor plan and section: foundation plate, ground floor
Date: 9 July 1962
Object: Apartment building Guaimbê
Location: São Paulo, Brazil
Time of construction: 1987
Architect: Paulo Mendes da Rocha
C4

MIRKO BAUM

Paper format: 122.6 x 87.6 cm
Drawing format: 118.4 x 83.7 cm
Drawing technique: Ink on tracing paper, marked with pencil, stamp, and red colored pencil
Scale: 1:10, 1:5
Plan contents: Point of view and sectional views
Date: 22 June 2003
Drafted by: Mirko Baum
Object: Transporter bridge over the Niers River
Location: Neersen-Cloerbruch near Mönchen-gladbach, Germany
Time of construction: 2003

C5

FRANZ FUEG, JACQUES HENRY

Paper format: 105 x 85 cm
Drawing technique: Ink on tracing paper
Scale: 1:1
Plan contents: Exterior wall details
Date: 3 March 1965
Object: Catholic Church
Location: Meggen, Switzerland
Time of construction: 1966

C6

SEVERIANO MARIO PORTO

Paper format: 86.5 x 61.5 cm
Drawing technique: Pencil on tracing paper
Scale: 1:100
Plan contents: Top view roof truss, rafter distribution
Date: December 1985
Object: Balbina Environmental Assurance Center
Location: Manaus, Amazonia, Brazil
Time of construction: 1985
**C1-C11**

**C10**
HANS
LEUZINGER
P. 69

- **Paper format:** 80.6 x 138 cm
- **Drawing format:** 78 x 135.4 cm
- **Drawing technique:** Pencil on sketch paper, stamp
- **Scale:** 1:1
- **Plan contents:** Section: window, wall
- **Date:** 4 October 1927
- **Drafted by:** Hans Leuzinger (not signed)
- **Object:** Holiday residence Uf dr Höchli
- **Location:** Braunwald, Switzerland
- **Time of construction:** 1927

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**C11**
ADAM
CARUSO.
PETER
ST JOHN
P. 71

- **Paper format:** 42 x 29.7 cm
- **Drawing technique:** CAD
- **Scale:** 1:100
- **Plan contents:** Top view: floor covering
- **Date:** 26 April 2002
- **Object:** Spatial design Stortorget
- **Location:** Kalmar, Sweden
- **Time of construction:** 1999-2003
BUILDING ELEMENTS
Building corners, windows, walls, and concrete elements: the drawings show individual parts of buildings, isolated details, and the building process. The plan for the corner of a building by Fritz Haller reveals its author's handwriting, although the radical inventor of the steel construction system was more interested in a universal language than his own handwriting. Paulo Mendes da Rocha's working drawing also shows a building corner, and in this case, "corner" refers to the lower edge of the floating volume. Like Haller's "round corner," also Da Rocha's building corner can be considered the key detail for the entire structure. The window of the furniture shop is twenty-four meters long, the glass pane is hung on the sill and barely touches the tapered balustrade. This is merely indicated by a hairline stroke, literally carrying to the extreme the de-materialization of the façade's expression. Next to it, the façade section of the Dominus Vinery by Herzog & de Meuron seems archaic. With rapid, confident strokes, Mario Meier draws the heavy pieces of rock in the wire-mesh gabions, the scarce water, and even the oak barrels on their bases: A practical plan for the building site, which nearly physically represents the earth, heat, light, and water. Albert Heinrich Steiner's façade detail is also about depiction of the material. Artificial stone, plastering, and concrete panels are applied with paint and brush onto the heliographic print. An ideal means for showing the plastering and also a suitable color sampling. The façade plan by Otto Glaus thematizes the building material concrete and its sculptural qualities. Glaus proceeds like a sculptor in composing his concrete surfaces. He draws them as though flat images, encircling numbers refer to the distance of the shell to the vertical coordinate; the relief is visible only on the completed building. The window of the observatory of the ETH and the Doldertal houses in Zurich are drawn at a scale of 1:1. Gottfried Semper drew the cross section of the wood forms without tolerances — rubber sealing would not appear for quite some time — yes, the dimensioning was missing. In the drawing by Alfred Roth, on the contrary, the craftsman can see precisely how he should attach the large sliding window. The beholder looks at the selected details in the plan by Álvaro Siza as though through a magnifying glass. They are drawn in carefully into the circular form, a great drawing effort, as there were neither selection tools nor mouse clicks. Mario Ridolfi's working drawings can be considered the apex of all window plans. Detailing, material qualities, atmosphere, everything is united in his drawing, even the perspectival view of the diagonally-placed clay brick rosette. Paul Bouvier also illuminated his building part from all sides. Even in the plan's captions, the pleasure in ornamentation and decor did not abate. Next to a tower extension from the belle époque is an air pipe, a mundane object. The plan by Spiro + Gantenbein decisively shows how even a simple building component requires comprehensive planning and that the plan has to be directed to tradespeople in diverse areas of building. Hidden in the air pipe are also electric cables for the long lighting element. One plan is not enough, above the plan header is a reference to seven additional plans for the same building element. In the plan by the Indian engineer Mahendra Raj, all themes contained in this chapter are united in a single drawing. It shows the building elements of a concrete structure. Rather than what looks like a spatial framework, for example, concrete panels furnished with filigree ribs form the covering and load-bearing structure of the sports stadium. The unusual element, however, is the geometry of the diagonally tilting panels, as the grid of the ribs is oriented on the horizontal: A seemingly simple measure for the sake of transparency and beauty. However, the working drawing shows that the geometry of the individual parts is complex. Next to the common horizontal view, another "normal view" is plotted out. And Raj's drawing, too, shows the entire building concept in the finest detail.
Paper format: 120.7 x 85.3 cm
Drawing format: 118.5 x 83.7 cm
Drawing technique: Ink on tracing paper, marked with pencil; lettering with template
Scale: 1:1
Plan contents: Floor plan and section: building corner
Date: 22 March 1965, revised 18 August 1966
Drafted by: Armin Riegert
Object: Höhere Technische Lehranstalt
Location: Brugg-Windisch, Switzerland
Time of construction: 1964–1970

Paper format: 106 x 107 cm
Drawing technique: Pencil and colored pencil on tracing paper
Scale: 1:10, 1:1
Plan contents: View and sectional views: windows
Date: 1972
Object: Casa De Bonis
Location: Ponte alle Cave (Terni), Italy

Paper format: 107 x 91 cm
Drawing format: 104.8 x 87.6 cm
Drawing technique: Pencil on tracing paper
Scale: 1:1
Plan contents: Horizontal and vertical sections: living room windows
Date: 10 September 1935
Object: Doldertal houses
Location: Zürich, Switzerland
Time of construction: 1935–1936
D4

**Otto Gläus, Ruedi Liennard**

- **Paper format:** 96.7 x 59.4 cm
- **Drawing technique:** Pencil, ink, stamp, label on tracing paper, lettering by hand and with template
- **Scale:** 1:20
- **Plan contents:** North façade: relief cement work
- **Date:** 22 July 1966
- **Object:** Jakobsgut II
- **Location:** Zurich, Switzerland
- **Time of construction:** 1966–1969

D5

**Alvaro Siza**

- **Paper format:** 95.5 x 45.5 cm
- **Drawing technique:** Heliographic print
- **Scale:** 1:50, 1:20, 1:2
- **Plan contents:** Sectional views and details
- **Date:** November 1959
- **Drafted by:** Alvaro Siza
- **Object:** Tea House Boa Nova
- **Location:** Leça da Palmeira, Matosinhos, Portugal
- **Time of construction:** 1963

D6

**Albert Heinrich Steiner**

- **Paper format:** 126.2 x 57.4 cm
- **Drawing format:** 125.5 x 56.8 cm
- **Drawing technique:** Gouache, pencil, ink on heliographic print
- **Scale:** 1:10
- **Plan contents:** Detail: west façade, window
- **Date:** 2 September 1950
- **Object:** High rises, Badenerstrasse-Letzigraben
- **Location:** Zurich, Switzerland
- **Time of construction:** 1951–1952
- **Site engineer:** Casetti und Rohrer Architekten
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<td>Gottfried Semper (not signed)</td>
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<td>Plan contents:</td>
<td>Detail section: wall construction: stone-filled gabions inside steel structure</td>
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<tr>
<td>Date:</td>
<td>28 June 1996</td>
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<tr>
<td>Drafted by:</td>
<td>Mario Meier</td>
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<tr>
<td>Object:</td>
<td>Dominus Winery</td>
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<td>Views, and top view, sectional views: ventilation pipe hanging</td>
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<td>Date:</td>
<td>14 November 2006, 17 November 2006</td>
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<td>Drafted by:</td>
<td>Peter Ozlberger</td>
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<td>Object:</td>
<td>Kirchgemeindehaus Wollishofen</td>
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D10
PAULO MENDES DAROCHA
P.97

Paper format: 100.8 x 70.2 cm
Drawing technique: Ink on tracing paper
Scale: 1:2, 1:10
Plan contents: Vertical and horizontal section: façade
Date: September 1989
Object: Furniture company Forma
Location: São Paulo, Brazil
Time of construction: 1994

D11
PAUL BOUVIER
P.99

Paper format: 72.2 x 64 cm, four pieces, the lengths of which are placed together
Drawing technique: Pencil, black and red ink, blue ink, watercolor, colored pencil on paper
Scale: 1:50
Plan contents: Views, sectional views and floor plan
Drafted by: Paul Bouvier (not signed)
Object: World's Fair 1900, Swiss Exhibition
Location: Paris, France
Time of construction: 1900

D12
MAHENDRA RAJ
P.101

Paper format: 126.3 x 94.6 cm
Drawing technique: Manually drawn in ink on tracing paper
Scale: 1:100, 1:50, 1:10
Plan contents: Views and sectional views: main structure - basic geometry
Date: 8 May 1980
Drafted by: P.N. Bose
Object: Sport Stadium
Location: Srinagar, India
Time of construction: 1979-1982
Architect: Morad Chowdhury
Partner: Kanvinde Rai & Chowdhury
Sternwarte.

Bastei-Fenster.

Zweites Fenster des 1. Stockes.
PARIS 1900

MOTIF CENTRAL DES GROUPE S VII ET X

INSTALLÉ DANS LE PALAIS DE L'AGRICULTURE ET DE L'ALIMENTATION

AU CHAMP DE MARS

FACE PRINCIPALE
ET COUPE TRANSVERSALE

LES DEUX FACES DE CHAQUE CÔTÉS
SONT SIMILAIRES. ICI Y A PLUTÔT
D'HORLOGE AFFRÈCHE ET DE L'ESCALIER.
LA GOURMETTE ENSUIVANTE DE L'UE CENTRE,
SANS ENTRE AU CENTRE.
HIDDEN STRUCTURE
"The form of the steel reinforcement should always give the impression of being a nervous system that brings to life the lethargic mass of concrete" (Pier Luigi Nervi, 1955). In his own buildings, Nervi made good on the demand he made of engineers. Outer form and inner flow of energy are in such compelling agreement that the skeleton seems to be visible through the body. The diamond pattern of ribs, circles of latitude, and meridians: Nervi's plan shows each individual layer of reinforcement separately.

Also the foundation plan for the Altes Museum in Berlin reveals a hidden structure. But in contrast to Nervi's reinforcement, Karl Friedrich Schinkel's plan is not concerned with tractive forces, but instead, loads. The foundation is made of wood! The Altes Museum rests on countless pine piles. The ground plan is not visible in the drawing, but its arrangement emerges with absolute clarity in the abstract grid structure, like the genetic pattern of a universal building type.

Light and elegant, the arches span Mahendra Raj's textile factory in Ghaziabad. In the detail plan, one can imagine the strength of the tensed arch. The reinforcement — "a nervous system that brings alive the lethargic mass of concrete." Nervi's biological metaphor puts it in a nutshell. The drawing brings to mind teaching panels for biology that show the human skeleton, circulatory system, and muscle strands. Flesh and skin are removed, one sees only the insides that keep the body alive.

Energy and tension are invisible dimensions; they make only an indirect appearance. For example, in Joseph Schwartz's detail plan for the pre-stressing of a honeycomb roof. For the naive beholder, the pre-stressed anchor may even recall high voltage power lines on poles.

One still wants to declare Nervi's demands made of concrete construction as valid. But what is hidden within the concrete mass today can hardly be restrained. Removed from the eye of the beholder, the building technology and infrastructure celebrate true orgies. Extending the demands Nervi made of engineers to building technicians seems daring. And yet, is there any reason that what applies to the reinforcement, should not also apply to house technology? In Hans Demarmel's plan for building technology, like an inner nervous system, the sanitary and heating lines hold together the curved wall fragments. The planning of Marcel Breuer's Staehelin House in Zurich was a transatlantic affair. The plan for the builder arose on the drafting table in America. The heliographic print crossed the Atlantic by post and in the end lay on the table in the Zurich building office, colorfully drawn over by the electrical designer. The fact that a modern coordination plan for high-tech building technology can also be aesthetic is shown by the roof construction of the elephant house at the Zurich zoo. The roof provides daylight and moonlight, tropical humidity, and rain. The plan very pragmatically shows the wiring arrangements and spacers for their assembly — but still, the drawing has something "spherical" about it. An unsuspecting beholder might even see it as the close-up of a cell.

On the building plan for the Leutschenbach School in Zurich, all that is visible are the load-bearing structure and building technology. That is enough to already envision the finished structure, the load-bearing concept and structural idea are one unit and the framework is everything. This applies in an even more radical way to the next example, too. A grid, four crosses: the plan shows only the naked infrastructure. The framework here is but a faint suggestion. What does the working drawing look like for a structure whose shell is composed of water and air? Or in other words: what does the building plan for a cloud look like? A mystery! The plan shows the machines that will ultimately generate the "edifice." The white cloud floats just above the water, beholders can rub their eyes as much as they want; it is still there the next day. Behind the magical appearance is pure technology.
Paper format: 97.4 x 64.4 cm
Drawing technique: Manually drawn in ink on tracing paper
Scale: 1:30, 1:15, 1:10
Plan contents: Sectional views and details: supply air duct, prestressing details
Date: 27 April 1971
Drafted by: Devender Kumar Chadda
Object: Textile Mill
Location: Ghaziabad (Uttar Pradesh), India
Time of construction: 1971-1973
Architect: Morad Chowdhury
Partner: Kanvinde Rai & Chowdhury

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Paper format: 126 x 80 cm
Drawing technique: CAD
Scale: 1:20
Plan contents: Details: prestressing of honeycomb ceiling
Date: 16 September 2009
Drafted by: Silvia Schwizer
Object: Expansion of the Congress Center
Location: Davos, Switzerland
Time of construction: 2009-2010
Architect: Heinrich Degelo

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Paper format: 80 x 70 cm
Drawing technique: Ink on tracing paper
Scale: 1:50
Plan contents: Horizontal sectional views: core grid of the dome
Date: 21 January 1957, 29 January 1957
Object: Palazzetto dello Sport
Location: Rome, Italy
Time of construction: 1958-1960
**E1-E9**

**E4**

ELIZABETH DILLER RICARDO SOFTIDIO

Paper format: 40.7 x 26.2 cm
Drawing technique: CAD
Scale: 1:300
Plan contents: Floor plan
Date: 1 June 2001
Object: Expo.02, Wolke
Location: Yverdon, Switzerland
Time of construction: 2002
Plan author: Staubli, Kurath & Partner

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**E5**

CHRISTIAN KEREZ

Paper format: 147 x 89.1 cm
Drawing technique: CAD
Scale: 1:50
Plan contents: Section: structure
Date: 3 December 2004
Drafted by: Andrea Casiraghi
Object: Schoolhouse Leutschenbach
Location: Zurich, Switzerland

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**E6**

HANS DEMARMELS

Paper format: 95.7 x 62.5 cm
Drawing format: 92.5 x 58.5 cm
Drawing technique: Ink on tracing paper, lettering with template, hatching on plastic film glued to backside
Scale: 1:50
Plan contents: Layout: plumbing installation, heating
Date: June 1965
Drafted by: Hans Demarmels
Object: House Cazenave
Location: Lanneplaa, Orthez, France
Time of construction: 1966
**E7**
MARCEL BREUER, EBERHARD EIDENBENZ
P. 121

- **Paper format:** 112 x 69.3 cm
- **Drawing format:** 107.4 x 67.3 cm
- **Drawing technique:** Colored pencil, ballpoint pen, pencil on heliographic print, stamp
- **Scale:** 1:50
- **Plan contents:** Floor plan: electrical plan
- **Date:** 30 July 1957 (floor plan), 12 February 1958 (electrics)
- **Drafted by:** A.G. (floor plan), Bruno Meyer (electrics)
- **Object:** Haus Staehelin
- **Location:** Zurich, Switzerland
- **Time of construction:** 1957-1958

**E8**
MARKUS SCHIETSCH
P. 123

- **Paper format:** 130 x 90 cm
- **Drawing technique:** CAD
- **Scale:** 1:100
- **Plan contents:** Floor plan: coordination plan: roof
- **Date:** 26 November 12
- **Drafted by:** Alke Misselhorn, Clemens Klein
- **Object:** Zoo, elephant park
- **Location:** Zurich, Switzerland
- **Time of construction:** 2012-2014
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<td>Scale:</td>
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<tr>
<td>Plan contents:</td>
<td>Top view: threshold plan for the foundation</td>
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<tr>
<td>Date:</td>
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<td>Object:</td>
<td>Altes Museum</td>
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<tr>
<td>Location:</td>
<td>Berlin, Germany</td>
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<tr>
<td>Time of construction:</td>
<td>1825-1830</td>
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TOOLS
With bold brush strokes, Gottfried Semper draws the flower garland for a frieze under the dome of the planetarium in Zurich. One half of the plan is blank paper. The attentive beholder, however, discovers little holes in this empty half of the drawing; the paper is pierced by countless needle pricks. Like with a sewing pattern, the painter can place the drawing onto the wet plaster and transfer the ornament directly onto the background through the holes: Semper's drawing is a tool at a scale of 1:1. Gustav Gul's plan is also furnished with small needle pricks. And here, too, only part of the ornament is drawn. Both drawings use the principle of the silhouette—which saves time, and the folding guarantees perfect symmetry. One knows the technique from the craft of turning; silversmiths also draw the plan for their goblets in a similar way. Although the drawing technique is the same for the two plans, they are different. Semper's bold characteristic style is off the cuff, while Gul, on the contrary, marked out his ornament with fine pencil under the charcoal strokes. The difference is obvious; Gul's garlands are stiffer, but in return, he does not need patches like in Semper's drawing. Hans Conrad Stadler's working drawings are based on the same folding principle. He cuts out the column profiles from the paper; a practical working instrument. Older architects might recall stencils and curved rulers. Like a controlling organ, they fit in between hand, drawing pen, and paper.

The formwork functions similar to the stencils. Those who want a precise picture of the formwork have to create a separate working drawing for the auxiliary construction. In Valerio Olgiati's formwork plan, each individual spacer is exactly measured. The plan shows only an aid, but in it, one can already imagine the finished building. Karl Moser even draws the formwork plan for his supports at a scale of 1:1. The growth rings are carefully drawn in pencil on the plan. The perfection of the preparation is transferred to the captions, even to the graphics in the working drawing: date and signature are not on the margins of the plan, as usual, but instead placed within it, in the framework of the form boards.

The plans gathered under the title "tools" range from sgraffito stencils to working drawings for scaffolding. For the opera house in Dresden, Semper even conceived an auxiliary construction for the auxiliary construction: a hoisting crane for the construction of the scaffolding. He meticulously painted it in watercolors, furnishing it with shadows, which is evidence of the draftsman's desire to see the finished work in the plan. Like a wooden cloak, the scaffolding encompasses Semper's opera house in Dresden. He draws the later structure as a barely visible surface behind the scaffolding. The drawing shows the fascinating aspect of constructional aids: the actual work is only alluded to, and disappears again as soon as the building is completed. Also the construction principles are different. The filigree truss construction of the scaffolding has nothing to do with the massive stone colossus of Semper's opera house, just as little or much as the tectonic wood formwork has to do with the amorphous concrete mass it embraces. As different as the scales and functions of the tools may be, all of the plans have something in common: they provoke imagination. Like a phantom image, they allow the later work to emerge before the eyes of the beholder.
| Paper format: | 84.4 x 86.8cm |
| Drawing technique: | Pencil on sketch paper |
| Scale: | 1:1 |
| Plan contents: | Floor plan: formwork of the supports |
| Date: | 5 September 1925 |
| Object: | St. Anthony Church |
| Location: | Basel, Switzerland |
| Time of construction: | 1925-1927 |

| Paper format: | 105 x 60cm |
| Drawing technique: | CAD |
| Scale: | 1:50 |
| Plan contents: | Views: formwork, corridor walls |
| Date: | 5 February 1998 |
| Drafted by: | Iris Datwyler |
| Object: | Schoolhouse |
| Location: | Paspels, Switzerland |

| Paper format: | 107.1 x 117.5cm |
| Drawing technique: | Charcoal on tracing paper, marked out with pencil, double folded and perforated |
| Scale: | 1:1 |
| Plan contents: | Perforation template: painted rosette |
| Drafted by: | Gustav Gull (not signed) |
| Object: | ETH Main Building, Renovation and expansion |
| Location: | Zürich, Switzerland |
| Time of construction: | 1914-1925 |

<p>| Paper format: | 109.4 x 215cm |
| Drawing technique: | Ink, diluted with water, on paper, folded and perforated |
| Scale: | 1:1 |
| Plan contents: | Perforation template: façade sgraffito |
| Drafted by: | Gottfried Semper (not signed) |
| Object: | Observatory of the ETH |
| Location: | Zürich, Switzerland |
| Time of construction: | 1861-1864 |</p>
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<tr>
<td>Plan contents:</td>
<td>Template for stone works: console and capital arch</td>
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<td>Scale:</td>
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<td>Plan contents:</td>
<td>Views and floor plan Treadwheel crane for wood scaffold, with wood parts list</td>
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<tr>
<td>Object:</td>
<td>Zweites Königliches Hoftheater</td>
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<tr>
<td>Location:</td>
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<td>Longitudinal section: scaffold</td>
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<td>Zweites Königliches Hoftheater</td>
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ANTONIUSKIRCHE BASEL

SÄULENSCHRÄLING

NATURDETALI

25.MAI. 5.9.57

K. MÖSCHEL
Alle Maße sind Abmessungen. Sie sind vom Unternehmen zu prüfen. Anzahlige Maß- 
differenzen sind der Bauausführung mitzuteilen.

0.00 = 791.35 m LWL

Plan Nr. 49 Wände 2.0G - SB Maß. 1:50

Korridor

Objekt:
Erweiterung Schülersaal Freiplatz

Baustelle:
Pfalzschule Gernsheim 1993 Freiplatz

Architekt:
Kleiner, Rügner, Blin Arch/CC/SA
Kleinerstraße 33, 65177 Wiesbaden, Tel 0611/911 12 96

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Format: 155 x 105 cm Datum 05.07.98 / 94 Rev. 05.02.94

0 1.5 3 6 m
MEASUREMENT AND NUMBERS
No working drawing without measurement. Measurements and numbers define the space between the building elements, their dimensions, the recording of the building, and — no least — the harmony of the structure. "Scala" means both scale and step; this double meaning also applies to Peter Zumthor's bell tower for the Sogn Benedetg chapel. The architect reduced the tower to an elementary gesture: what is required to raise a bell. The tower is a ladder! Like the ladder to heaven in Jacob's dream, the bell bearer rises to the heights. But the ladder is not intended for climbing; unevenly spaced rungs forbid its secular use.

Two dimensional chains alongside the sectional and elevation views show the intervals between the rungs and the decreasing distance of the ladder's sides from the vertical axis: The higher the tower, the narrower the ladder; and therefore, the smaller the interval between rungs. From the point of view of the beholder, an exaggerated perspective arises. It is the principle that Gian Lorenzo Bernini applied in the Scala Regia in the Vatican. Karl Moser also drew a dimensional chain alongside the tower of the Johanniskirche, but the joints of the stone slabs disappear under the extensive ornament.

The dimension between axes of the Residenz Hélio Olga in São Paulo measures 330 centimeters. On the working drawing, the house looks like an engineer's structure. This impression is not deceptive as the wood construction is a cooperative work by architect Marcos Acayaba and engineer Hélio Olga — a structural masterpiece. The building site is precarious, the slope nearly vertical; there is no space for either the scaffolding or the building crane. The house is both a tower and a bridge. Spatial and load-bearing structures are one and the same here.

Measuring tape, pencil, and paper suffice: the scale is the central instrument of the recording technique. The documentation plan for Gut Steinhausen is drawn with painstaking precision. The projection of the beams, purlins, and rafters let the entire roof rise before the eye of the beholder. Even the process of measuring is legible in the fine lines. The plan is a spatial survey; the fine network of lines recalls a celestial chart. That, too, is a recording, but of an entirely different dimension!

The ground plan of the Gisel House is dimensioned without interruption. This draftsman has mastered the art of clearly arranged dimensioning; a great deal of practice is required before every dimension line sits correctly and no others get in the way.

The dimensioning serves not only the builder, but also the architect for checking mass and proportion. The numerical ratio of the roof plan for the National Gallery in Berlin is 5:8:5. Mass and number are nearly everything here. The space in between is what counts. Ludwig Mies van der Rohe built with a minimum of building components. For him, mass and proportion are "building materials," like concrete and steel.
**G1**
PETER
ZUMTHOR
P.149

**Paper format:** 42 x 80.7 cm  
**Drawing technique:** Pencil and colored pencil on sketch paper  
**Scale:** 1:20  
**Plan contents:** View: bell tower  
**Date:** May 1988  
**Drafted by:** Peter Zumthor  
**Object:** Sogn Bendeteg Chapel  
**Location:** Sumvitg, Switzerland  
**Time of construction:** 1988

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**G2**
HÉLIO
OLGA
P.151

**Paper format:** 100 x 70 cm  
**Drawing technique:** Pencil on tracing paper  
**Scale:** 1:25  
**Plan contents:** Section: structure  
**Date:** October 1988  
**Drafted by:** Helio Olga  
**Object:** House Helio Olga  
**Location:** São Paulo, Brazil  
**Time of construction:** 1990  
**Architect:** Marcos Acayaba

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**G3**
UTA
HASSLER
P.153

**Paper format:** 89.8 x 62.6 cm  
**Drawing technique:** Pencil on paper  
**Scale:** 1:25  
**Plan contents:** Site survey exercise, floor plan: penthouse manor  
**Date:** 1996  
**Drafted by:** Marco Boelsen, Christine Harkort, Martina Loeser  
**Object:** Gut Steinhausen  
**Location:** Witten near Bömmern an der Ruhr, Germany  
**Time of construction:** 17th to 19th century  
**Plan author:** Uta Hassler, professor for monument preservation and architectural research, Technical University Dortmund
Paper format: 83.4 x 88.4 cm
Drawing technique: Ink on tracing paper, marked with pencil, header and stamped on detail references
Scale: 1:50
Plan contents: Floor plan: ground floor
Date: 14 October 1965 (wrongly dated 14 October 1938), revised 26 November 1965, 14 January, 24 January, 26 April, 10 May, 6 June, 23 June and 29 June 1966
Object: Haus Gisel
Location: Zumikon, Switzerland
Time of construction: 1965–1966

---

Paper format: 112.1 x 81.2 cm
Drawing technique: Gray-line print
Scale: 1:100, 1:20, 1:5, 1:1
Plan contents: Bottom view and cross section: ceiling, details: lights and hanging
Date: 30 August 1965
Drafted by: signed "k. A."
Object: New National Gallery
Location: Berlin, Germany
Time of construction: 1965–1968

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Paper format: 60.8 x 99.6 cm
Drawing format: 58 x 96 cm
Drawing technique: Ink on tracing paper, dimensional lines in red and green ink, marked out with pencil
Scale: 1:20
Plan contents: View: tower
Date: November 1902
Object: Johannes Church
Location: Mannheim, Germany
Time of construction: 1902–1904
NUMERALS AND SYMBOLS
The first impression when looking at the garden plan drawn by Brazilian landscape architect Roberto Burle Marx is of an abstract painting. A closer look, however, shows small black numerals on the color surface: the picture gives instructions for planting! Every numeral identifies a different type of plant and shows the gardener where to place the seedlings.

Numerals and symbols are the key to the plans in this chapter. Every plan has a code to be deciphered. What at first seems mysterious opens unanticipated insights upon closer inspection. As though under a magnifying glass, clear outlines of the characteristic building concept appear in the cryptic symbols.

Roberto Burle Marx's gouache pictures are characteristic: he designs his gardens with color and structure. Never is there one single plant, but instead, large amounts of the same sort. Bushes and flowers are the colors on his palette. He uses them to compose his walk-in pictures. The rooftop garden of the Ministry in Rio de Janeiro is conceived as a picture: to the delight of the officials in the neighboring high rise when they look out the window.

In Gerhard Richter's plan for the church window in Cologne Cathedral, the numerals stand for colors. The colorful grids, on the contrary, identify the window levels in the cross section of the tracery. Seventy-two color hues are distributed on 11,263 squares. But in contrast to Burle Marx, Richter distributed the glass colors randomly. The finished work of the glazier ultimately reveals the plan.

On the roof plan for the Rolex Learning Center in Lausanne, every figure identifies a panel, and every panel is shaped differently. The arrangement of the 1,400 panels is plotted on a map like the coordinate network on a map. And in fact: the library visitor strolls over the modulated ceiling as though over the hills and dales of a landscape. On the other hand, "structural contour lines," like on a map, are found on the plan by Froelich & Hsu Architekten. The drawing shows the concrete molding of the three diving towers. For the map-reading beholder, the code of the contour lines is a familiar one. Even when the lines run vertically, one immediately sees the impressive concrete form from the image of the "contour lines."

Different yet again is the working drawing by the Viennese architects Hubmann and Vass. The ground plan shows the parking facility for the Alhambra in Spain. The cars stand under almond trees, the entire structure is an irrigation system in the tradition of Moorish garden design. This plan is actually about surveying a landscape, but instead of contour lines, countless height measurements decorate the plan. The slope must be exact to the last millimeter in order for the irrigation system to work. With its dots, the plan looks like a nautical chart: hidden in the pencil figures is a topography of the grounds.

Contour lines are drawn on the garden plan for the San Telmo palace in Seville. Although it looks like the view from below of a ceiling in a baroque church, in reality, it is a plant plan. The geometric contour lines are not intended for the stucco plasterer, but the gardener. They denote the hilly plant beds. The circular segments are precisely set, Roman numerals give the number and sort of the seedlings and the gray dots the appropriate volumes of soil. The plan is white only in the places where there are trees. The plant beds trace out the shadow of the tree tops, under which the visitors stroll, under the parching sun of Seville.

At the end of the series is a drawing by Carlo Scarpa. It, too, is encoded. The colors designate the different sorts of stones of the beige colored panels. In between are practical notes: "telefonare," for example, so that the master does not forget to call in the revisions! That is characteristic for Scarpa. None of his structures were ever planned to the finish. The building site was the place where changes were made at all times and even at the last minute. For Scarpa, working drawings are design sketches, and his sketches are working drawings. Hidden in each and every one of his details is the building concept as a whole.
H1

**DESIGN TO PRODUCTION**

**P.165**

- **Paper format:** 84 x 59.4 cm
- **Drawing technique:** CAD from 3D model
- **Scale:** 1:250
- **Plan contents:** Floor plan: formwork elements
- **Date:** 23 January 2008
- **Drafted by:** Fabian Scheurer
- **Object:** Learning Center der EPFL
- **Location:** Lausanne, Switzerland
- **Time of construction:** 2007–2010
- **Architect:** Kazuyo Sejima, Ryue Nishizawa

H2

**ROBERTO BURLE MARX (RECONSTRUCTION)**

**P.167**

- **Drawing format:** 92.2 x 46.4 cm (reconstruction), 198.6 x 100 cm (original)
- **Drawing technique:** Gouache on paper
- **Scale:** ca. 1:24
- **Plan contents:** Top view, planting plan roof garden
- **Date:** 1937
- **Object:** Edificio Gustavo Capanema
- **Location:** Rio de Janeiro, Brazil
- **Time of construction:** 1936–1938
- **Architect:** Lúcio Costa, Oscar Niemeyer, Carlos Azevedo Leão, Jorge Moreira, Affonso Eduardo Reidy, Ernani Vasconcelos; Le Corbusier (architect consultant)

H3

**ERICH HUSMANN, ANDREAS VASS**

**P.169**

- **Paper format:** 157 x 65 cm
- **Drawing technique:** Pencil on tracing paper
- **Scale:** 1:500
- **Plan contents:** Site plan
- **Date:** 7 December 1992
- **Drafted by:** Andreas Vass
- **Object:** Rearrangement of the entrance area to Alhambra
- **Location:** Granada, Spain
- **Time of construction:** 1994–1997

H4

**ADRIAN FROELICH, MARTIN HSU**

**P.171**

- **Paper format:** 42 x 30 cm
- **Drawing technique:** CAD
- **Scale:** 1:50
- **Plan contents:** Floor plan and view: diving towers
- **Date:** 13 August 2008
- **Drafted by:** Natasa Radulovic
- **Object:** Diving towers, outdoor swimming pool
- **Location:** Brugg, Switzerland
- **Time of construction:** 2008–2009
H5
GUILLERMO
VÁZQUEZ
CONSUEGRA
P.173

Paper format: 84.1 x 59.4 cm
Drawing technique: CAD
Scale: 1:200
Plan contents: Floor plan; composition of the landscape planting
Date: July 2004
Object: Conversion of the San Telmo Palace
Location: Sevilla, Spain

H6
CARLO
SCARPA
P.175

Paper format: 63.2 x 43.2 cm
Drawing technique: Graphite and colored pencil on cardstock
Scale: 1:10
Plan contents: Façade view with floor plan; outer covering
Drafted by: Carlo Scarpa
Object: Castelvecchio Museum
Location: Verona, Italy
Time of construction: 1964

H7
MEIKE
HOFFMANN,
MARC
WIETHEGER
P.177

Paper format: 59.4 x 134.5 cm
Drawing technique: CAD
Scale: 1:20
Plan contents: View, interior windows: grid spacing, color assignment
Date: August 2006
Drafted by: Meike Hoffmann, Marc Wietheger
Object: Cathedral
Location: Cologne, Germany
Time of construction: 2007
Design: Gerhard Richter
ERSATZ SPRUNGTÜRME FREIBAD BRUGG

AUSFÜHRUNG Sprungtürme Plangröße: A3 Rev: 13.08.2008 nr
Sprungturm 1Meter/3Meter/5Meter M 1:50

Bauherrschaft: Einwohnergemeinde der Stadt Brugg Hauptstrasse 5 5200 Brugg
Bauingenieur: Mund Ganz und Partner AG dipl. Bauing. ETH/SIA Aarauerstrasse 69 5200 Brugg
Architekt: Froelich & Hsu Architekten ETH_BSA_SIA AG Neugasse 10 8005 Zürich
E8

INTERSTICIO (185m²) 9 u/m²
10% Oliva minuta = 187u
30% Cyrtomium falcatum = 500u
20% Vincia minor = 468u
30% Opysocus japonicus = 500u

E9

INTERSTICIO (260m²) 9 u/m²
20% Oliva minuta = 468u
20% Cyrtomium falcatum = 468u
20% Vincia minor = 468u
40% Opysocus japonicus = 936u

E10

E11

INTERSTICIO (72m²) 9 u/m²
25% Convolvulus canescens = 162u
25% Gazania longiscapa = 162u
50% Hemerocallis sp. = 324u

Nota: Las plantas de los intersticios se mezclan
generando mixtos de una sola especie nunca superiores a 1=2
Definición de módulos en plano correspondiente.
CATALOGUE
In the plan by engineer Hélio Olga there is an axonometric drawing for each single wood joint so that the tradesperson could place every screw in the right place accurately to the millimeter. The natural harmony of the engineer's house is based on its precision, which extends to the smallest detail. Dolf Schnebeli's Casa dei Bambini has an entirely different, rough character. Yet also his detail section shows the same precision. The drawing mediates between the work fields, since for the final details the concrete must be properly prepared. The slight offset in the cast-in-situ concrete roof edge on 64/A36 guarantees that the concrete front and sheet metal lining are truly flush, and the recessed row of bricks on 41/A36 that the baseboard does not project unattractively. No detail can be missing. Schnebeli's béton brut strives for perfection. The fact that innumerable detail plans are necessary is shown by the examples of plans in this chapter. They are technical drawings without any allure: joining details in countless versions, figures and numbers refer to detail plans and object lists. Yet these sober drawings, which often even recall the pages of a building catalogue, are of a precise perfection and even make it possible to recognize the architect's handwriting. They show that the technical discipline is also a creative one. Karl Egender's plan looks like the pages of an alphabet book. The overview drawing is a key plan in the building process. Álvaro Siza's catalogue of sectional views also has this function. A plan like this challenges the imagination of the craftsperson. But the master personally helped on the construction site and sketched the details directly, with his unmistakable handwriting, on the plan. The technician who was meant to carry out the instructions on the assembly plan for the Clarte House was definitely put to the test. "T13 comparable with T17, but with O and Y in place of O1 and C1." The remark appears countless times and always in new versions on the plan. Heavy thinking is demanded here!
The information on the elaborately drawn plans elucidate the architect's eternal crux: in the morning, the working drawing goes to the building site, in the evening everything should be fully assembled. What was meticulously planned over several weeks must now be completed in just a few hours. Hannes Meyer's drawing is a catalogue of standardized sectional views through roof and floor. The stone base in the ground floor, the year rings in the wooden beams, cork scrap filling, and ceiling plaster — all of the details are drawn so clearly that the beholder hardly has to read the captions. The draftsman has expanded the standardized crosshatching and textures. For every scale, the appropriate measure of abstraction must be found; an important issue in plan drawing. Cramer Jaray Paillard's plan is a typical example of prefabrication. Eighty-six different connections are drawn on the plan. The notice on the top edge of the paper refers to the plans where the same details can be found, always in different combinations. The plan also shows the problems of prefabrication. The desired efficiency is not always so easy to realize, and when at least four elements are the same, then architect and foreman can consider themselves lucky. The plan by Séquin-Bronner & Knobel looks like a true catalogue page: The steel supports can be produced for every building in the desired number and length.
**J1—J8**

**J1**
HELIO OLGA
P. 183

- **Paper format:** 100 x 70 cm
- **Drawing technique:** Pencil on tracing paper
- **Scale:** 1:10 and 1:1
- **Plan contents:** Sectional views and axonometric view
- **Date:** December 1988
- **Drafted by:** Helio Olga
- **Object:** House Helio Olga
- **Location:** Sao Paulo, Brazil
- **Time of construction:** 1990
- **Architect:** Marcos Acayaba

**J2**
DOLF SCHNEBLI
P. 185

- **Paper format:** 116 x 92 cm
- **Drawing format:** 105 x 83 cm
- **Drawing technique:** Pencil on tracing paper, lettering in ink with template, stamped heading, visible views copied over in ink
- **Scale:** 1:10 and 1:5
- **Plan contents:** Sectional views and axonometric views: floor-wall-roof
- **Date:** 15 March 1971, revised 17 March 1971, 16 September 1971
- **Drafted by:** signed “Me”
- **Object:** Casa dei Bambini
- **Location:** Locarno, Switzerland
- **Time of construction:** 1971–1973

**J3**
LE CORBUSIER, JOHN TORCAPEL
P. 187

- **Paper format:** 76.5 x 74.5 cm
- **Drawing format:** 74 x 72 cm
- **Drawing technique:** Heliographic print, stamp
- **Scale:** 1:10
- **Plan contents:** Views: types of window frames
- **Date:** 27 May 1931 (heliography), 29 May 1931 (stamp)
- **Object:** Maison Clarté
- **Location:** Geneva, Switzerland
- **Time of construction:** 1931–1932

**J4**
KARL EGENDER, WILHELM MÜLLER
P. 189

- **Paper format:** 131.5 x 156.5 cm
- **Drawing format:** 124.3 x 151.5 cm
- **Drawing technique:** Ink on tracing paper, marked out with pencil, lettering with template and by hand
- **Scale:** 1:100
- **Plan contents:** Floor plan and sectional views: supports, beams
- **Date:** 13 January 1938
- **Object:** Indoor stadium
- **Location:** Zurich, Switzerland
- **Time of construction:** 1938–1939
J5
ALVARO
SIZA
P.191

Paper format: 78 x 59 cm
Drawing technique: Heliographic print, pencil and ballpoint pen
Scale: 1:20
Plan contents: Views, sectional views, floor plan and perspectival sketches: windows and doors
Date: November 1959
Drafted by: Álvaro Siza
Object: Tea House Boa Nova
Location: Leça da Palmeira, Matosinhos, Portugal
Time of construction: 1963

J6
HANNES
MEYER
P.193

Paper format: 107.2 x 61.2 cm
Drawing format: 105.2 x 59.6 cm
Drawing technique: Heliographic print
Scale: 1:2
Plan contents: Sectional views: ceilings, floors
Date: 1 March 1938
Object: Genossenschaftliches Kinderheim / Cooperative children's home
Location: Mümmliswil, Switzerland
Time of construction: 1937-1939

J7
FRED
CRAMER,
WERNER
JARAY,
CLAUDE
PAILLARD
P.195

Paper format: 152.8 x 67.1 cm
Drawing format: Two pieces put together
Drawing technique: Ink on tracing paper, pencil hatchings on the back side, lettering with template and by hand, header on plastic film glued onto back, paper framed with textile tape
Scale: 1:10
Plan contents: Floor plan: details of the parts' attachments
Date: 29 September 1964
Drafted by: signed "EV"
Object: Wohnbebauung Grüzfeld
Location: Winterthur, Switzerland
Time of construction: 1965-1968

J8
SÉQUIN,
BRONNER,
KNobel
INGENIEURE
P.197

Paper format: 81 x 139.5 cm
Drawing format: 79.2 x 137.3 cm
Drawing technique: Ink on tracing paper, marked out with pencil, template lettering
Scale: 1:10
Plan contents: Views, sectional views, floor plan
Date: 29 December 1899
Object: Norms for cast-iron beams
TYPES CHASSIS

FAÇADES (SUITE)

T13 ressemble à T11, mais avec O et Y

T14 ressemble à T18, mais avec O et Y

T15 ressemble à T11, mais avec O1 et O

T16 ressemble à T12, mais avec O1 et O

T20 ressemble à T19, mais avec 2630 au lieu de 2565.

T12 ressemble à T11, mais la porte a droite.

T21 avec C
t21 avec Y

T22 avec B

T23 G

T24 G

T18 ressemble à T17, mais la porte a droite.

GENÈVE, LE 27
ECHELLE 10
GENSOSSCHAFTLICHES KINDERHEIM IN MÜMSWIL
STIFTUNG VON DR. BERNHARD UND PAULINE SEEGÜE, FREIBURG

N°24 DECKEN UND BÖDEN, NORMALSCHNITTE

ARCHITEKT: HANNES MEYER - FABRICA, GENÈVE

1:2

193

J6
HANNES
MEYER
DISTANCE
The oldest working drawing in this book is a full four meters tall and drawn with iron gall ink on parchment paper. If the plan were to be enlarged 36-fold, it could be laid almost perfectly onto the façade of Cologne Cathedral. Not only its sheer size is impressive, but also the precision it maintains in terms of detail at a small scale. This extends from the base through to the distant roof top. Every individual rosette, every stone embellishment is accurately drawn, although only the birds would see the stone masons’ artistic work on the roofs. The work was not created solely for human beholders, but instead, devoted to the higher powers. The size of the plan already is amazing. But truly unusual is that it shows the entire view of the huge edifice. This was possibly the first time that a masonry workshop was confronted with such extensive planning.

The working drawing by Giuseppe Mengoni is 5.15 meters long and shows views and sectional views of the upper stories of the Galleria Vittorio Emanuele II in Milan. The structural elements are drawn with red ink, and every stone is furnished with a number. A table on the edge of the sheet provides information about the mass and volume of each individual stone. The sheer length of the plan makes it impossible to entirely roll out the plan on the table, thus the beholder can only view the detailed drawing in excerpts; an experience also had by a person walking through a gallery.

The structures shown in the working drawings gathered in this series have almost no similarities. The plans, on the other hand, operate with large scales or great distances, even when the building parts are small. The blue prints by Curjel & Moser recall the view through a telephoto lens of a tower top in the night sky. The top of the Paulus Church in Basel is six meters high, the shaft under the bronze peak is only two centimeters. Passersby should see only the cross in the heavens. Also the characters written on the plan for the university in Bern are created for a view from afar. In the drawing by Otto Rudolf Salvisberg and Otto Brechbühl, everything through to the writing on the plan and the stamp is of a piece. Only the selection of the few letters poses a riddle.

Sustenstrasse, a mountain pass road in Switzerland and Eero Saarinen’s TWA Terminal in New York are works whose programs refer far beyond their actual dimension. The mountain pass connects north and south; the airport, entire continents. Both drawings are discussed in detail in the essay section of this book. The train station of the Durchmesserlinie in Zurich is of comparable dimensions. The density of information on Jean-Pierre Dürig’s plan, however, is much greater and allows us to imagine what is involved in coordinating the innumerable professionals involved in the project.

The most unusual working drawing in this book refers to immensely huge dimensions and at the same time, immeasurably small ones: the building plan for the Large Hadron Collider in Geneva. The cross section shows a machine that is as large as a house, and has been included in the present collection as the only exception — please forgive us. The construction shown on the plan measures twenty-five meters. The inquisitive beholder can zoom in for endless close-ups on the screen, through to the smallest screw. Even greater is the sheer extent of the space that this structure is meant to measure.
<table>
<thead>
<tr>
<th>K1</th>
<th>JEAN-PIERRE DURIG</th>
<th>P.203</th>
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<tbody>
<tr>
<td>Paper format:</td>
<td>273 x 89cm</td>
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<td>Drawing technique:</td>
<td>CAD</td>
<td></td>
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<tr>
<td>Scale:</td>
<td>1:200</td>
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<tr>
<td>Plan contents:</td>
<td>Floor plan: general plan</td>
<td></td>
</tr>
<tr>
<td>Date:</td>
<td>17 January 2012</td>
<td></td>
</tr>
<tr>
<td>Drafted by:</td>
<td>Katharina Labhart, Luiza Kitanishi</td>
<td></td>
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<tr>
<td>Object:</td>
<td>Diameter line: Altstetten - Zürich HB - Oerlikon, train station - Lowenstrasse</td>
<td></td>
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<tr>
<td>Location:</td>
<td>Zürich, Switzerland</td>
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<td>Time of construction:</td>
<td>2007-2014</td>
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<th>K2</th>
<th>MEISTER ARNOLD</th>
<th>P.205</th>
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<td>Paper format:</td>
<td>166.5 x 406.5cm</td>
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</tr>
<tr>
<td>Drawing technique:</td>
<td>Iron gall ink on parchment</td>
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<td>Scale:</td>
<td>likely 1:36</td>
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<td>View: west façade</td>
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<td>Object:</td>
<td>Cathedral</td>
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<tr>
<td>Location:</td>
<td>Cologne, Germany</td>
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<td>Time of construction:</td>
<td>1248–1880</td>
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<table>
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<th>ROBERT CURJEL, KARL MOSER</th>
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<td>Drawing technique:</td>
<td>Blue-line print</td>
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<td>Scale:</td>
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<td>Plan contents:</td>
<td>Section: intersectional tower</td>
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<tr>
<td>Date:</td>
<td>8 May 1900</td>
<td></td>
</tr>
<tr>
<td>Object:</td>
<td>St. Paul’s Church</td>
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</tr>
<tr>
<td>Location:</td>
<td>Basel, Switzerland</td>
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<td>Time of construction:</td>
<td>1898–1901</td>
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<th>ALAIN HERVE</th>
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<td>Scale:</td>
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<tr>
<td>Plan contents:</td>
<td>Longitudinal view of the Compact Muon Solenoid experiment for LHC</td>
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<tr>
<td>Date:</td>
<td>2 November 2011</td>
<td></td>
</tr>
<tr>
<td>Drafted by:</td>
<td>CMS Engineering &amp; Integration Team, Dmitriy Drzhkin</td>
<td></td>
</tr>
<tr>
<td>Object:</td>
<td>Physics detector, CERN underground experimental area</td>
<td></td>
</tr>
<tr>
<td>Location:</td>
<td>Cessy, France</td>
<td></td>
</tr>
<tr>
<td>Time of construction:</td>
<td>2007</td>
<td></td>
</tr>
<tr>
<td>Plan author:</td>
<td>CMS collaboration and CMS Engineering &amp; Integration Centre</td>
<td></td>
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<tr>
<td>K5</td>
<td>EERO</td>
<td>P. 211</td>
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<td></td>
<td>SAARINEN</td>
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</tbody>
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| Paper format: | 121.9 x 91.4 cm |
| Drawing technique: | Pencil on vellum |
| Scale: | 1:96 |
| Plan contents: | Floor plan, upper floor, Main Building Center |
| Date: | 12 July 1963 |
| Drafted by: | signed “CJWC” |
| Object: | TWA Unit Terminal Building |
| Location: | New York, USA |

| K6  | EUGEN | NIL | P. 213 |

| Paper format: | 104 x 47 cm |
| Drawing technique: | Watercolor on heliographic print |
| Scale: | 1:1000 |
| Plan contents: | Site plan |
| Date: | 1.3.1942 |
| Object: | New construction: Sustenstrasse |
| Location: | Gemeinde Gadmen, Switzerland |
| Time of construction: | 1939–1946 |

| K7  | OTTO RUDOLF SALVISBERG, OTTO BRECHBUHL | P. 215 |

| Paper format: | 103 x 62.2 cm |
| Drawing format: | 100 x 59.5 cm |
| Drawing technique: | Pencil and colored pencil on tracing paper, stamp |
| Scale: | 1:1 |
| Plan contents: | View and section view |
| Date: | 27 October 1931 |
| Object: | Institute of the University of Bern |
| Location: | Bern, Switzerland |
| Time of construction: | 1929–1931 |
| Purpose: | Lettering on the entrances PHARMAZEUTISCHES INSTITUT, ZOOLOGISCHES INSTITUT, GEOLOGISCHES & MINERALOGISCHES INSTITUT |

| K8  | GIUSEPPE MENGONI | P. 217 |

| Paper format: | 515.3 x 69.8 cm |
| Drawing technique: | Black and red ink, sectional lines in blue ink, watercolor on linen paper |
| Scale: | 1:20 |
| Plan contents: | Views, floor plan and sectional views: stone works, parts lists |
| Date: | 1 March 1871 |
| Object: | Galleria Vittorio Emanuele II |
| Location: | Milan, Italy |
| Time of construction: | 1865–1877 |
Situationsplan 1:1000
Ausführungsplan
ERWEITERUNGSBAUTEN
DER UNIVERSITÄT BERN
BUCHSTABEN MST M1
Disegno generale di tutta la parete del primo piano per la decorazione e produttione delle relative pietre da taglio.

30 giugno 1829

L. [indetta]
SPACE
The cutaway has proven itself. With ground plan, sectional plan and view, nearly every building concept can be mediated in the working drawing. The spatial concept is orthogonal. It is no new thing, however, for space and building forms to burst the classical triaxial schema of spatial depiction. Sculpturally formed building parts and spatial niches have always demanded expanded forms of depiction. In the plan by Antonio da Sangallo, the longitudinal section combines with the interior view of the church. The central viewing point is missing, and the draftsman used the central perspective, which was already known at the time, only in fragments. The perspective-based views into the side chapels help the beholder interpret the plan.

Other means for heightening the spatial effect are colors and shading. They give plasticity to the ceiling plan of the Bundeshaus. Hermann Czech, on the contrary, uses forth is the projection of the cutting lines. In the building plan for the café bar in Palais Schwarzenberg, two dotted lines supplement the sectional drawing. They already suffice to make the arch visible. Rafael Moneo, in his working drawing for the National Museum for Roman art, combines sectional drawing and axonometric depiction. Our skeptical inquiry to the architect's office as to whether this plan is actually a working drawing was set straight: the axonometric drawing has a plan number and was explicitly drawn for use on the building site. "Eran otros tiempos," the times were different, as the office of the master says. The plan served the craftsman to understand the complex structure. The view from below is unusual, it shows the development of the wall, layer for layer, and lets the beholder judge the load of the stones. The time and the force that the mason spent to lift every stone into place is stored for eternity in the countless pencillines. The cross sections of the wall in the axonometric drawing show that with it, Moneo built a genuine Roman brickwork.

The classical means of 3-D depiction are not always enough. The drawing, however, can show disparate views at the same time. The façade development of the New Monte Rosa Hut is drawn based on the principle of the paper cut-outs of famous monuments. It shows all views simultaneously and enables the architect a view of the entire geometrical body. And as it does in so many cases, the working drawing reveals here, too, a fundamental building concept: the long climb comes to a crowning conclusion in the path along its shell.

Representing complex spatial structures in a flat drawing is one of the most difficult tasks of plan drawing. With Maison Carre, Alvar Aalto built an expressive space. The sectional plan suffices, as the dynamic form of the ceiling arises solely from the cutting profile. The case is different with the interior space of the concert hall in Sydney's Opera. Jørn Utzon's virtuoso creation of space demands everything from the draftsman. And no less from the craftsman! The plan not only has to be drawn, it also has to be realized. View and bottom view of the ceiling are shown in one. A key on the right margin of the plan explains the specially developed system. However, when the drawing is nonetheless stretched to its limits, the model helps. Mahendra Raj's roof plan for the Hindustan Lever Pavilion is drawn only from the model, and the measurements are to be taken from it, as is noted on the plan. How one can capture space in one look with the classical cutaway drawing alone, is shown by Francesco Borromini in his drawing of the church tower of Sant' Ivo alla Sapienza. In one single plan he combines ground plan, sectional view, and view. No correct perspective can possibly dupe the eye so cleverly. Like the tiles of a mosaic, the various cutaways settle in the mind of the beholder to an overall view. Mario Ridolfi uses the same means in his bay plan. He masterfully blends roof view, façade, sectional view, and ground plan.
Paper format:  84.3 x 56.2 cm
Drawing technique:  Ink and watercolor on handmade paper
Scale:  ca. 1:90
Plan contents:  Longitudinal section of the main transept
Date:  Beginning of 1545
Drafted by:  Anonymus Destailleur
Object:  San Pietro in Vaticano
Location:  Rome, Italy
Time of construction:  1538-1546

Paper format:  97 x 54 cm
Drawing technique:  Pencil and ink on tracing paper
Scale:  1:10
Plan contents:  Interior detail: bar room, east wall
Date:  9 October 1984
Drafted by:  Walter Grur
Object:  Palais Schwarzenberg, Restaurant floor, refurbishment
Location:  Vienna, Austria
Time of construction:  1983-1984 (destroyed)

Paper format:  37 x 90.8 cm
Drawing technique:  Graphite on paper
Scale:  ca. 1:31
Plan contents:  Combination of section and view
Date:  1652
Drafted by:  Francesco Borromini
Object:  Church Sant'ivo alla Sapienza, dome lanterns
Location:  Rome, Italy
Time of construction:  1652-1653
L4  MARIO RIDOLFI  P.231

Paper format:  69.5 x 120 cm
Drawing technique:  Ink and pencil on tracing paper
Scale:  1:50, 1:10, 1:5
Plan contents:  Combination of floor plan, section, and view
Object:  Casa Ottaviani
Location:  Norcia (Terni), Italy

L5  ANDREA DEPLAZES  P.233

Paper format:  118.9 x 84.1 cm
Drawing technique:  CAD
Scale:  1:50
Plan contents:  Façade development
Date:  19 September 2008
Drafted by:  Kai Hellat
Object:  New Monte Rosa Cabin
Location:  Zermatt, Switzerland
Time of construction:  2008-2009
Plan author:  ETH Studio Monte Rosa, ETH Zurich, Andrea Deplazes, Marcel Baumgartner, Kai Hellat; Bearth & Deplazes Architect, Daniel Ladner

L6  MAHENDRA RAJ  P.235

Paper format:  118.9 x 84.1 cm
Drawing technique:  Manually drawn in ink on tracing paper
Scale:  1:100
Plan contents:  Top view and detail sections: reinforcement concrete plates
Date:  18 August 1961
Drafted by:  Mr. Rath
Object:  Pavilion for Hindustan Lever
Location:  Pragato Maidan, New Delhi, India
Time of construction:  1961
Architect:  Charles Correa
RAFAEL MONEO
P. 237

Paper format: 128 x 106 cm
Drawing technique: Pencil on tracing paper
Plan contents: Sectional axonometric view
Date: September 1980
Drafted by: Enrique de Teresa
Object: National Museum of Roman Art
Location: Mérida, Spain
Time of construction: 1980-1986

JORN UTZON
P. 239

Paper format: 128.3 x 99.3 cm
Drawing technique: Heliographic print and blue colored pencil
Scale: 1:48
Plan contents: Plan and elevation of internal contours: ceiling, minor hall
Date: 13 July 1964
Object: Sydney Opera House
Location: Sydney, Australia
Time of construction: 1959-1973
L9
ALVAR
AALTO
P. 241

Paper format: 120 x 44 cm
Drawing technique: Pencil on tracing paper
Scale: 1:20
Plan contents: Longitudinal section
Date: 13 March 1956
Object: Maison Louis Carré
Location: Bazoches-sur-Guyonne, France
Time of construction: 1956–1959

L10
HANS
WILHELM
AUER
P. 243

Paper format: 46.5 x 42.5 cm
Drawing technique: Watercolor and ink on tracing paper, marked out with pencil
Scale: 1:50
Plan contents: Ceiling view: Federal Assembly Hall
Object: Parliament building of the Federal Palace
Location: Bern, Switzerland
Time of construction: 1894–1902
Whether Cologne Cathedral or Jean Prouvé's weekend house—the largest and the smallest buildings in this book—the human is always the reference and scale figure. Furniture and scale figures are not part of the working drawing, but they are the invisible protagonists in this plan series. The plan for the sanitary facilities in Lux Guyer's housing complex for working women is a classical scheme drawing. The copy does not reveal whether the appliances on the original are drawn with a stencil or stuck on with film. The sanitation facility designer had to supplement the black-and-white heliographic print with colored marker, color copies didn't exist yet. The picture of the bathtubs lined up in a row and water boiler is relevant only for the expert, and yet it mediates to today's beholder something of the modest, but at the time comfortable pleasures in the everyday lives of the residents.

The apartment ground plan at a scale of 1:20 is by Atelier 5. The brick and concrete walls are seamlessly dimensioned; at this stage of building, the builder needs no more. Only when furnishing begins does it become clear how made-to-measure the empty spaces are, not a centimeter too large or too small for the everyday life of an average family. Economy demands utter precision in dimensions. That also applies to the furniture. In Lina Bo Bardi's theater seating, the seats and seatbacks are set cleverly against one another and with little effort, the anchoring of the armrest is stable. The agreement of structure and body mass—absolutely mandatory for furniture—is, in principle, also applicable to every other building element, even a garden. The human stride defines the arrangement and dimensions of the step treads and ground slabs in Dieter Kienast's garden. In the plan by Baumann Rosens Architekten, the measuring figure is the tram. Like the stencils and sticky film of Lux Guyer's plan, today it is a file that can be directly copied into the drawing—to the joy of the draftsperson when dealing with a clearly furnished tram wagon in which all that is missing are passengers. The plan for a tram station unites vehicle and structures, mobile and fixed elements. The structures are small, but the program unrelenting.

The building plan for the USM-Werkhalle and the machine laboratory at the ETH are both furnished, as both buildings are custom-built precisely for their purposes. Under the free grid field at USM Haller—the plan simultaneously shows the projection of the underview of the ceiling—the production process defines the arrangement of "furniture," while in the machine lab, the test devices define the space. Recessions in the space and machine parts are put to paper true-to-detail in a virtuoso spray technology.
M1
LUX
GUJER
P. 249

M2
LINA
BOBARDI, ANDRé
VAINIER, MARCELLO
FERRAZ
P. 251

M3
ATELIER 5
P. 253

M4
LORENZ
BAUMANN,
ALAIN
ROSEREINS
P. 255

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**M1 - LUX, GUJER**

- **Paper format:** 103.1 x 50.6 cm
- **Drawing format:** 102.3 x 49.8 cm
- **Drawing technique:** Heliographic print, colored pencil
- **Scale:** 1:50
- **Plan contents:** Section: plumbing installation
- **Date:** November 1926
- **Object:** Frauenwohnsiedlung Lettenhof
- **Location:** Zurich, Switzerland
- **Time of construction:** 1925-1927

**M2 - LINA**

- **Paper format:** 110.3 x 82.5 cm
- **Drawing technique:** Pencil on paper
- **Scale:** 1:50, 1:5
- **Plan contents:** Floor plan and sectional views: theater, seats
- **Date:** 1979
- **Object:** SESC, Fábrica da Pompeia
- **Location:** São Paulo, Brazil
- **Time of construction:** 1977-1986

**M3 - ATELIER 5**

- **Paper format:** 107 x 51 cm
- **Drawing format:** 104 x 48 cm
- **Drawing technique:** black ink, red colored pencil, and black stamped ink on tracing paper
- **Scale:** 1:20, 1:5
- **Plan contents:** Floor plan: upper floor, house type 380
- **Date:** 24 February 1958, revised on 5 November 1959 and 24 December 1959
- **Drafted by:** Heinz Blum
- **Object:** Siedlung Halen
- **Location:** Herrerschwanden, Switzerland
- **Time of construction:** 1959-1961

**M4 - LORENZ BAUMANN, ALAIN ROSEREINS**

- **Paper format:** 118.9 x 84.1 cm
- **Drawing technique:** CAD
- **Scale:** 1:50
- **Plan contents:** Floor plan
- **Date:** 7 August 2007
- **Drafted by:** Isabel Gutzwiller
- **Object:** Tram station
- **Location:** Limmatplatz, Zurich, Switzerland
- **Time of construction:** 2006-2007
**M1-M7**

**PETER PAUL STOCKLI, DIETER KIENAST, HANS-DIETMAR KOEPPEL**

**M6**

**BENJAMIN RECORDON**

**P.259**

**Paper format:** 190 x 140 cm

**Drawing technique:** Ink, watercolor, spray technique

**Scale:** 1:30

**Plan contents:** Floor plan

**Object:** Machine laboratory of the ETH Zurich, Switzerland

**Location:** Zurich, Switzerland

**Time of construction:** 1897-1900

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**M7**

**BRUNO HALLER, FRITZ HALLER**

**P.261**

**Paper format:** 187.1 x 89.6 cm

**Drawing technique:** Heligographic print on tracing paper, ink, lettered with template, colored plastic film and hatching on back side, marked out with pencil

**Scale:** 1:50

**Plan contents:** Floor plan, layout plan for production machines

**Date:** Heliographic print 15 November 1961, revised until 22 August 1962, Date of the layout plan not signed

**Object:** Rebuilding of the plant U. Schärer's Söhne Münsingen

**Location:** Münsingen, Switzerland

**Time of construction:** 1964

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**Paper format:** 119.6 x 78.7 cm

**Drawing format:** 107.6 x 66.5 cm

**Drawing technique:** Pencil on tracing paper, heading on plastic film glued to back side, hand-lettered

**Scale:** 1:100, 1:20, 1:10

**Plan contents:** Layout with details

**Date:** 28 October 1989

**Drawn by:** Dieter Kienast

**Object:** Garten Eschler

**Location:** Uitikon-Waldegg, Switzerland


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**Paper format:** 187.1 x 89.6 cm

**Drawing technique:** Heliographic print on tracing paper, ink, lettered with template, colored plastic film and hatching on back side, marked out with pencil

**Scale:** 1:50

**Plan contents:** Floor plan, layout plan for production machines

**Date:** Heliographic print 15 November 1961, revised until 22 August 1962, Date of the layout plan not signed

**Object:** Rebuilding of the plant U. Schärer's Söhne Münsingen

**Location:** Münsingen, Switzerland

**Time of construction:** 1964
Maschinen-Laboratorium

am Eidgenössischen Polytechnikum - Zürich.

Maßstab 1:50

~ Grundriss ~
ESSAYS
Means of communication between drawing table and building site

Working drawings are depictions of an imagined future. They mediate how something should be built, and thereby betray things that even after the completion of the building, one can find out only here, secrets large and small: how big is the cross at the very top of the tower of the Paulus Church in Basel \(\rightarrow K3, p. 207\)? How thick are the light-penetrable stone panels of the Pius Church in Meggen \(\rightarrow C5, p. 59\)? And how did Gottfried Semper generate the perfect symmetry of his sgraffiti on ETH Zurich’s observatory \(\rightarrow F4, p. 137\)? The answers are in the working drawings.

For their characterization, however, what they do not show is just as enlightening. That which is not to be built is sacrificed to the economy of the drawing: people appear in our collection in only one single plan \(\rightarrow B5, p. 41\). While people surface on design plans as measurement figures, this reference is not necessary in implementation designs. Instead, there are exact numbers, independent and universal, unrelated to human bodies. The plans also do not show a building’s environment. No neighboring structures can be seen, none of the existing trees or public streets—barely a hint of a city or countryside. In some drawings, the spatial context is missing entirely, as space, too, is not built, but merely encompassed. This is illustrated by the detail collections in the “Catalogue” chapter of this publication. The 1939 construction plan for the children’s home in Mümliswil, which Hannes Meyer drew for a publication, shows this in a way that is particularly easy to grasp \(\rightarrow F9, p. 11\). Like in a collage, he cut away large parts of the interior space. There is an implosion with the roof directly above the floor, a mutilated wall, the drainpipe cut in the middle. An entire house at a scale of 1:5 shrinks to the size of a handy piece of paper—for the mediation of the structure, the space is of no importance. Most working drawings in our collection are pure line drawings. Strictly speaking, ink and pen do not draw the actual objects themselves, but instead, merely outline them. In the way that a line divides various spaces in a schematic ground plan sketch, in the working drawing, a line divides different materials. The stroke separates air from stone, stone from wood. The borders are drawn, the matter of interest lies between them. Only the crosshatchings break this abstraction: they form the fillings, which identify the materials themselves.

Copied originals, original copies

I have never seen the originals of many of the plans gathered in this book. The single sheet of paper that the draftsperson had before them for hours or weeks is in the archive of an architectural office, a university, or a museum. The owner sent us only a scan of the plan. For printing, a digital copy is entirely sufficient, the original is not necessary. At the same time, the identification of an original is often not clear; instead, there is considerable blurriness in its relationship to the copy. In contrast to an artwork, for example, a working drawing is not the final product of a process, but rather, an intermediary stage with respect to a goal. The ongoing work is reflected in the plans. Subsequent corrections and adaptations are thereby found not only on originals, but also on copies. When Álvaro Siza corrects and supplements door details on a heliographic print \(\rightarrow J5, p. 191\), he thus increases the importance of the copy—and at the same time, questions the authority of the original on which it is based: those who still continue to design with the original sheet are working with the wrong material. A similar amalgamation of copy and original can be seen in the façade plan by Albert Heinrich Steiner \(\rightarrow D6, p. 89\). Painted color areas overlie a
heliographic print so that an entirely new plan emerges, the copy is part of an apparently independent original. However, our collection also contains untouched originals whose actual designation is as copy. An example of this is the plan by Otto Glauz and Ruedi Lienhard (+D4, p. 85), which comprises multiple techniques. The lines of pencil, ink, and stampare first aligned in the reproduction, allowing the shadow of the header-film glued on from behind to disappear. The original of the plan by Atelier 5 (+M5, p. 251) seems nearly forged. The drawing was not meant to be in color; the crosshatchings are drawn in red only so that they appear in the heliographic print in the intended gray—an actual victory of the copy over the original. From here, it is only a short way to the computer plan common today. The original now remains locked in the machine; only the print-outs, copies duplicated as often as one likes, make it out into the world.

The handicraft of the draftsperson

Something is nonetheless missing when one has a copy before them rather than the original. With regard to artworks, Walter Benjamin wrote: "Even the most perfect reproduction of a work of art is lacking in one element: its presence in time and space." That also applies to architectural drawings, at least to handwritten plans: who wouldn't prefer an original architectural sketch to a first-class copy? Those drawings that I have held in my hand as "original specimens," have become my favorites, especially in the present collection. Most originate from the ETH Zurich's in-house gta archive. When looking at the plans, I can see the draftsperson at work: a pencil travels over the paper, an ink pen draws line after line, and a razor blade scrapes away the errors. Someone carefully colored in an ink plan in the nineteenth century; another spent hours gluing on film after film of sketches are preserved here, but also all other documents that accrue in the work of an architect: personal letters, notebooks, diaries, and also cost schedules, time plans, basic schedules, models—and working drawings.

Recordings of conversations

The working drawing marks the step in architectural work from the drawing table to the building site. It can be a personal means of expression or, likewise, impersonal instructions. Whereas a sketch has a clear author, it is characteristic that only a few of our examples, were drawn by the architect whose name the office bears. Often, an abbreviation from an unknown draftsperson is evidence that the designing architect stepped back and allocated the mediation of a project to an employee. Examples of this are the pencil drawings by Mario Meier for Herzog & de Meuron (+C8, p. 65, p. 93). The more differentiated the division of labor in a project, the less clear the authorship of a plan. For example, the plan created in 2012 for the expansion of Zurich Main Station clearly had more than one author (+K1, p. 203): architect, civil engineer, and building technician all had their part not only in the building, but also in the working drawing. With historical plans, on the contrary, the author's name often remains a mystery. A header with complete information about the architect, paper format, scale, content of the plan, date, draftsperson, and property first appears in our collection in drawings from the second half of the twentieth century. Whereas this supplemental information in today's plans sometimes takes up a large portion of a sheet, in earlier plans often even the scale is not identified. The gaps reflect the character of the medium. The working drawing is a tool; it is destined for the building site, not eternity.

When we study plans, we are witness to a discussion. The architect speaks to the tradesperson, engineer, and building technician all had their part not only in the building, but also in the working drawing. With historical plans, on the contrary, the author's name often remains a mystery. A header with complete information about the architect, paper format, scale, content of the plan, date, draftsperson, and property first appears in our collection in drawings from the second half of the twentieth century. Whereas this supplemental information in today's plans sometimes takes up a large portion of a sheet, in earlier plans often even the scale is not identified. The gaps reflect the character of the medium. The working drawing is a tool; it is destined for the building site, not eternity.

An indefinable number of documents are distributed in a half-dozen spaces on the Höngerberg campus as well as in three further archives in Oerlikon and in the city of Zurich. In terms of containers, in the two main rooms alone I count: 96 plan chests with eight drawers each for A0 formats; 84 hanging files with 4 drawers each for A4 formats; 166 running-meters of floor-to-ceiling shelves; and additionally, 2,700 plan rolls. Altogether, the gta archives preserve the estates of 220 architects in addition to a collection of countless individual documents. The search in the in-house archives was richly rewarding, for reasons other than their proximity. In contrast to other archives, not only beautiful diagrams and ingenious design sketches are preserved here, but also all other documents that accrue in the work of an architect: personal letters, notebooks, diaries, and also cost schedules, time plans, basic schedules, models—and working drawings.
Paris and additionally, painted a separate legend. Back at the building site, the two sheets served the painter for remixing. Roth carefully preserved the documents and forty-one years later, as he wrote in his memoirs, the original sample was used once again in the restoration of the buildings. On the plans, in addition to the color determinations, also a warning can be read from the master to the still inexperienced Roth: “attention: exiger de l’ouvrier une propreté absolue: pots propres, pinceaux propres, couleurs propres!” On all types of working drawings, a more general instruction has become standard: “The dimensions are to be checked on the building.” The sentence warns the plan’s reader of gullibility: the drawing is only an idea of future reality—should the future not agree with the plan, then the foreman is the one in charge.

Again and again, sender and receiver change; the working drawing is invariably a means of communication. Most intimate are the notes on the edge of the paper. This small strip belongs to the drafts-person alone. Here, stroke samples are depicted as a frenetic pattern, complementing the precise order of the plan drawing. But the drafts-person also leaves behind his or her traces with telephone messages, calculations, sketches, to-do lists: silent soliloquies at the drawing board.
Good architecture can be described, it wouldn't have to be drawn. The Pantheon can be described. Secession buildings can't.
Adolf Loos

Through the use of flowered borders, labels, details, and by emphasizing the individual conception, even the simplest orthogonal projection can be transformed into a work of art worth looking at.
Otto Wagner

Realization
Loos's statement can be understood in two ways: first, three-dimensional concepts can be so elementary that they can be expressed through verbal abstraction. (Repeated misquotations of this Loos passage cite the Parthenon rather than the Pantheon, which naturally ruins the argumentation.) A narrow idea of industrialization also believed that the design could rest so entirely on a (prefabricated) building system, that it could be conveyed by means of lists, or even, on the telephone.

Understood a bit more broadly, established building conventions could also be understood as regulatory, meaning that only deviations from them have to be drawn out. In most cases, Loos could assume that the practitioner—the tradesperson—was able to work largely independently within a tried-and-true tradition, which has no longer been the case since the mid-twentieth century, at the latest. At any rate, discussion here is of the plan whose purpose it is to communicate a design intention, and to do so to those who are integrated in the realization.

Design
It is alluring to grasp architecture in language. The architect Wolfgang Mistelbauer (1934–2007) said of our shared work in the 1960s, "Back then, Czech pursued the idea of the possibility of transferring the verbal concept into a form. —I, on the other hand, upheld the position that there was, additionally, something like visual artistic thinking; a way of thinking in non-verbal connections, an inner 'logic' of forms, of space. Of course one can also describe that verbally, but that would be a translation in a foreign language."

In drawing, one attempts to pursue a thought and to test it, or more precisely: to combine several thoughts, to blend, condense. But those are actually visual thoughts even when they are accompanied and founded by terms and language beyond the drawing—sometimes jotted down next to it. The thoughts—the visual as well as the linguistic—are located at different levels: they range from lines, building elements, spaces, colors, products, and models through to associations and ways of behaving. They are heterogeneous. They are at various scales or not to scale.

The sketch, the drawing as a stage of thought, becomes "obsolete," valueless, and distracting as soon as the design progresses; you can destroy it. That may be much to the regret of later analysis, architectural historiography (should such a thing exist). But aren't we our own historians? A feature of Konrad Wachsmann’s design pedagogy was that all group members used the same paper format and could not throw away any sheets so that the path of all arguments from every participant could be traced back, and work could continue from a previously reached point.

And isn't the individual design of a single person likewise a chronological series of decisions? Those who design must live with previously made decisions—or reverse them, in the same way as with a conversion, what exists must be accepted or sacrificed. Then you have to return to an earlier state, which is preserved in the documentation.
But these methodical sketches are unsigned, whereas a plan, which is meant to assure the implementation by others, bears the official signature of the author or the office. Why should I sign a sketch? I know my own name, it’s superfluous. The only sensible information would be a date—thus providing the position in the chronology of the design process. A genuine, original design sketch never bears the name of the architect.

Of course, drawings can also be exhibited, but only in connection with the developed concept, as part of the process that leads to the structure. The beauty of a drawing is misleading. The attraction of a sketch is its transcending character; it refers beyond itself as medium of a message or as preparatory study for something else. Like “design,” it is only understandable with reference to something else, which it should first serve. Drawing and design become mendacious and ludicrous when viewed as finished products, dismissing their transcending aspects.

Detail
The word “detail” was once commonly used for something that was less important in comparison with the whole, and would be dealt with later. Although it is common knowledge that god and the devil are in the details—not only because that’s where the water will get in, but also because the details repeat and produce the context of the structure.

The computer favors a less-hierarchical view of decisions. Although the plan on the computer screen never shows the particulars and the overview simultaneously (at best, they have to be printed out and viewed the same way as hand-drawn ones in full size), it does force one to define every detail, at least to the extent necessary for it to take its position in the overview; a fleeting, not-to-scale sketch of partial problems would negate the effort saved by using the computer. (When, however, the thought is not as precise as the machine, the plan is far from disclosing its errors.) Yet every detail is simultaneously a whole, and vice versa. There is no ranking of scales. “Detail” is the particular decision field under observation at a time; the scales intertwine. The term simply steers attention to something else at a given moment. Christopher Alexander’s theory of the generation of form rests on this perspective: its patterns are relations between various elements, but these elements are, themselves, patterns.

There is, of course, architecture that is unaffected by the outsourcing of working drawings and detail planning, because even then, it will look peculiar.

“Atmospheres”
What can a draft show before it is built? During the process of creating a design, one would like to have an anticipatory idea and control of its effect. Is it possible to visualize a building or an interior, “the way it will be”?

Before I entered the master class of Ernst A. Plischke at Vienna’s Academy of Fine Arts, I was of the strict opinion that this is not only impossible, but also reprehensible as an attempt; one deceives people by presenting images of something that does not yet exist. Plischke taught me to produce such perspectives, to even turn them into a methodological tool. But I still refuse to insert people in them; instead, the beholder should feel drawn into the space.

In terms of current computer simulations, I likewise tend toward a systematic approach. I do not show any more than I know—which is naturally a handicap, especially in competitions. Only in a very late stage of a design can a rendering depict a building or a space in a realistic way.

Persuasion and seduction
Or is it possible, to predict the result in the idea—and express it as image? The beginning quote by Otto-Wagner aims at a plan that is meant to communicate a design intention—though, to those making decisions about realization.

Wagner speaks of the drawing as an artwork. For him, “art” has two contexts of meaning, which are found at different levels. On the one hand, it often means the effort at sculptural invention, which—also on the building—can be metered out according to need. However, on the other hand, art means the architectural thought itself; the idea that is gained from the synopsis of the material: “A good, great thought is to be grasped before the pen is set in action, and carefully pondered.” Heinrich Kulka also said about Loos: “Loos saw all results with his inner eye, even the most complex spatial arrangements, like someone walking through the building, before he took a pencil in hand.”

Can the finished design emanate from the mind? The experience of having seen what one has planned as built reality, a process that always takes years, might cumulatively prevent one from being surprised by outcomes. But the amount and heterogeneity of the matters to be decided upon and of the participants make the design a process.

Its respective state is, thus, defined; but should always be justifiable. The tragic ensnarement of architecture competitions is that what is judged are supposed results, but in truth, they are only initial approaches. The tragic aspect is that there is no awareness of this fact. Still, organizers and jurors believe to be selecting finished dishes, where in truth, available are merely parts of recipes.

Nonetheless, like with modern cookbooks, there are also deceptive illustrations. In fact, the image, not the thoughts, carry the medial representation of the architecture. Images buzz around, in which one sees everything; except for what will be made.

Assumptions
Since the early twentieth century, classical isometric projection—that is, the undistorted ground
The article contains reworked passages from earlier writings.

Plan set obliquely and with true-length verticales—has confronted a perspective-based concept of space with the idea of a field and delivered an "objective" image of a design that is not only three-dimensional, but also measurable. Joining in, in the "postmodern" era, was also the view of the open ground plan from below, that is, looking upward into the space, which facilitated the imagination of (usually historical, or historicizing) vaults. It is precisely these depictions that are not possible with commercially available CAD programs.

One can do a lot on the screen that cannot be done with a pencil on paper, such as correct a curve without having to erase it first, approaching what is ultimately intended through hatching, but then filtering out only that.

To be able to work further on something already achieved, to selectively represent different contexts through different layers, could lead from the teamwork of specialist areas to an uncomplicated teamwork of design proper. In generating form, computer programs can go beyond the designer's spatial concept; and the designer, for his or her part, can expand the area of experience with this resource, so that an enriched spatial awareness can be expected. Unfortunately, these expansions do not lead—as hoped for by some—to a new philosophy of space, but often, in contrast, to trivial ornamentation.

And ultimately, one can print out three-dimensionally, which brings Heinz Frank's utopia from 1971 a bit closer. My generation and the following one did not learn to draw on the computer. (Fritz Kurrent, who is even a bit older, said: "What do you want from me, I am a twentieth-century architect"). In the most intense moments of design, we are dependent on relating our ideas to staff members, as we watch, and are usually unable to understand the steps required, and in order to perceive the results, must ask that they stop zapping between scales.

But those who do not reject new technologies on principle, are able to image what might be possible, and even complain about what is not yet possible.
One of my favorite architecture books is the catalogue Partituren und Bilder (Scores and Images) by Peter Zumthor. Depicted in it are three projects that led to his international breakthrough: The Chapel Sogn Benedett in Sumvitg (+Gl 5.149), the Atelier Zumthor in Haldenstein near Chur, and the protective structure over the Roman excavation in Chur. The catalogue was published on the occasion of the eponymous exhibition at the architecture gallery in Lucerne in October 1988. Along with texts by Martin Steinmann and Peter Zumthor, it contains a series of blueprints or working drawings and black-and-white photographs by Hans Danuser, which shaped the reception of Zumthor's architecture in the years that followed. The book interests me not only because those photographs were published in it for the first time, and they meanwhile represent a milestone in the history of architectural photography. I am also interested in it because of the depth of meticulous working drawings, which allow the beholder to retrospectively glance over the architect's shoulder, as it were. And ultimately, the book is significant because a series of lines of development that are seminal in the history of visual culture overlap therein. The publication marks that brief moment in the late 1980s of reshuffling the cards of architectural representation.

At the time of the exhibition, Zumthor was in his mid-forties. He had run his own office since 1979 and could already look back on a respectable career and various visiting professorships. However, he had clearly presented more designs in lectures and published form than he had actually built. This career path, marked by a long phase in which only a few structures are realized, was characteristic for the entire generation of young architects at the time. In fact, it is difficult to imagine from today's perspective that during the 1970s and 1980s, the status of architects was defined more by what they hadn't built than what they had. Due to a lack of commissions, many architects turned their energy to the production of images, models, and texts. The architectural biennale in Venice, called to life in 1980, was the most important platform for exchange. And a specialized trade in architectural representations, led by the gallery of Max Protetch in New York, which had specialized in architectural drawings since 1978, moved architectural drawing into the light of the booming art market.

Because architecture is slow, it was only able to profit with delay from the economic boom, which followed the recession of the 1970s. It wasn't until the early 1990s that progressive architects of the middle generation were confronted with an increasing number of commissions. It is well known that this trend culminated in the phenomenon of signature architecture and the star architects around the turn to the twenty-first century. Zumthor's exhibition, which opened in early October 1988 in Lucerne—by the way, just one day after the exhibition Architektur Denkform by Herzog & de Meuron at the Architecture Museum in Basel—was at the intersection of these changes and bore witness to the explosiveness of the issue of architecture's representation at the time.

It is illuminating that Zumthor strove vehemently against the fixation (and reduction) of the architectural drawing to an art object. At the moment when architecture and the fine arts seemed to move most closely together, he insisted on their clear separation. His plea for the "reality" of architecture was quite clear in this respect:
presentation no longer contains any 'openplaces' that we can let our imagination penetrate, and allow for the formation of curiosity about the reality of the depicted, then the representation itself becomes the coveted object. The desire for the real object pales. Little or nothing refers to the reality that is meant that lies outside of the representation. The representation no longer contains a promise. It refers to itself. These types of representations—architectural drawings as independent art products—have no significance in my work."4

Without naming any names, Zumthor distinguishes himself from colleagues such as Herzog & de Meuron, Daniel Libeskind, Zaha Hadid, Steven Holl, Aldo Rossi, and others who were predominant in the area of architectural representation in this era and were represented in a number of exhibitions by sketches and drawings, which functioned and were treated like autonomous artworks. However, Zumthor was not interested in criticizing specific positions, that is, in doing what Martin Steinmann, for example, did in the same catalogue with the reference to "postmodern buildings."5 Instead, or at least according to my theory, he was interested in quite explicitly choosing one medium for the exhibition, and omitting others for conceptual reasons, even when he gladly used them otherwise. That becomes clear in the next section of his text when he emphasizes that the exhibition is also not about presenting design drawings. Although the "drawings and sketches that emerge when designing," which as "traces of architectural discovery" offer evidence of "successes and errors," belong among his instruments of design and would have undoubtedly pleased the visitors to the exhibition.6 "Project plans" were equally out of place in the exhibition, in that they are a "comprehensive, but preliminary representation of an idea," which it aimed at "clients, authorities, and prize judges."7

Zumthor relied on the "working drawings" or "building plans."8 He wanted to show these in the exhibition because, as he writes, they have "the character of anatomical drawings." They show, as he believed, "something of the mystery and inner tension that the completely assembled architectural volume no longer disguises: the art of assembly, hidden geometries, the friction of the materials, the inner energy of load-bearing and holding, the human work that is in the things." Even more emphatic than the metaphor of the anatomical drawing is the comparison with the musical score. He viewed it as a "compulsory base" for "performance" and emphasizes that only that which it does not contain is left to "performance practice, and interpretation by the performers." The final section of the text attests to the great extent that architecture was in the hands of other media at the time, and how open the gates of the genres were at the moment:

"This exhibition shows architectural scores. And it shows images of works performed on the basis of these scores. The language of the images is the artistic language of photographer Hans Danuser. He uses this language to speak about our performances."9

Danuser's photos decisively shaped the reception of Zumthor's buildings in the 1990s. As the architect himself remarked, the working drawings were, on the contrary, intended mainly for specialists. Yet nonetheless, their presentation in the exhibition is worth contemplating as is their characterization by the architect as "scores." After all, for quite some time, no other architect had so clearly formulated the hypothesis that the exhibition should not focus on the building itself as a finished product (or the reference to this product), but instead, what is found between the intention and the reality, what is first capable of setting the process of realization in motion, namely, the working drawing. When Zumthor, as quoted above, refers to the "human labor that is in the things," then he alludes to a theme that architecture had largely repressed in the nineteenth and twentieth centuries, namely, the alienation of people from the products of their labor as diagnosed by Karl Marx. The operation of representation, characteristic of the entire visual culture of the nineteenth and twentieth centuries, that is, the translation of a reality into another medium corresponds with the capitalist economy because it masks this alienation. In a representational economy revolving around art's self-referentiality, which has been dominated by what has been identified as "l'art pour l'art" (art for art's sake) since the mid-nineteenth century, there is no place for the working subject.

In his exhibition, Zumthor wanted to again bring into play the repressed figure of the working person. Here is the key to his skepticism with regard to all forms of abstraction, and his persistent insistence on the singular, the concrete, and real. That is also the base for his rejection of the sketch, in which the design process is abbreviated, as it were—and made heroic as an artistic or "ingenious" act. He was not concerned with staging the plan as fetish, that is, as replacement for the whole, but rather, as manifestation of a complicated, protracted process without which, architecture would not be possible. According to my thesis, the architect's labor is present in the form of the working drawing. This explains why the working drawings were not—as common in architectural publications—reworked and "corrected" for the audience. Zumthor printed them in the form of documentary photos, so that it was possible to follow the multiple individual lines of the façades constructed from slats, so that the specifications and information, as well as the plan headers were legible, and it might be possible to reconstruct the building on the basis of the available data. He does
not thereby negate the repetitive— at times, in the production, also monotonous— character of the design depictions, that is, the slats drawn neatly next to one another, the meticulously outlined stones, the details of the construction. The simple lines— still drawn by hand at the time, nearly a decade before the introduction of the computer— simultaneously show the labor, as well as pleasure in the work. The beholder could imagine how long it took to produce the drawing and could identify for a moment with the architect, the draftsman, the artisan. At the moment that the reader opens the catalogue, for a brief moment, like music, the architecture is present, and at the same time, unfathomable in its built form.
It is often said how profoundly the production of architecture has changed in the wake of the digital revolution. It is less often noted how architecture has resisted the seductive flourishes of digital production and maintained a dogged continuity with social and historical space. Bricks remain bricky even when laid by a robot borrowed from the car factory. Timber remains fibrous despite the scorched traces of the laser cutter and these remain the rare marriages of new technologies with ancient tectonics. More often than not, architecture continues to evolve within the present, dragging a past into the future full of conflicted meanings and associations. Occasionally architecture is also revolutionary, rupturing with the past to establish the unencumbered new. Paper architecture has long been a by-word for the avant-garde, for un-built and the un-buildable architectural rhetoric. Yet even in revolution, the representation of architecture uses the same abstract notation of orthographic plans, sections, and elevations established in the Renaissance. As with all architectural (r)evolutions, the primary battleground has been in drawings and, dare I say it, on paper. The architectural drawing sits ambiguously with both revolution and tradition. Architects still examine the plan to understand the underlying spatial and conceptual ideas. The common language bridging the architectural imagination with a constructed reality is in the conventions of technical drawing. In many ways it is surprising that these conventions have survived the changes in architectural production and society at large. The past three centuries have seen a complete transformation in industrial production and society and, in the last twenty years, communication has done the same. The survival of the architectural drawing, the plan, while everything has changed places it into the realm of a quasi-language rather than professional technique, a system unlinked to the phenomena it represents with its own rules and codes. The architectural drawing is a means of creation, production, reproduction, and execution, which like musical notation, is created and read by the initiated, a semi-open code of ideas and instructions specifying exact execution or inviting interpretation. The architectural drawing is one of very few means of production to endure despite changes in culture and technique over five centuries from steel point and quills, to graphite to mechanical ink pens and even as CAD replaced the hand in the closing decade of the twentieth century.

I entered an architectural office for the first time in 1989 for a summer job before starting architectural studies. The office of around forty people was quiet and busy with architects either standing or sitting on tall stools hunched over drawing boards arranged at assorted angles to suit their users. My first task was to change single fire exit doors on a plan to doubles. A simple if rather banal task for a young would-be architect. I was shown to my board and handed my first Rotring pen, scale ruler, blue clutch pencil, and, crucially, a small packet of razor blades to erase the offending doors scattered across the A0 tracing paper drawing.

Like all skills required of a good draftsman, scraping away a very thin layer of ink without damaging the paper requires practice. I clumsily gouged away with the razor into the paper’s surface removing more paper than ink and eventually cutting through my finger, too. The rest of the day was occupied with removing dried blood from the complex field of fine black lines that was the primary ground floor plan, the general arrangement drawing or GA for short. Needless to say that I developed the art of erasure ahead of the full range
of drafting skills but for the record, in time, these also improved.

Over the following five years at architecture school and in offices, we would draw for several hours a day, developing speed and precision alongside a growing awareness of the nuances of architectural drawings. Ink on trace was the mo-dus operandi of a British architectural office but occasionally, one would use film, a heavy-duty translucent plastic sheet that looks like tracing paper but behaves completely differently. Film is tough stuff. It was used for long-term drawing that would be updated over years, say the ground plan of a major building. But the film does not absorb ink, it stays liquid on the surface for what seemed like an eternity when facing a deadline and of course it can be erased with a special rubber (or eraser, probably electric, as our American colleagues would have them). At the other end of the scale, in smaller architectural offices, one would use pencil on detail paper, thin and soft, a cousin of tissue paper favored for presenting luxury goods. With pencil and detail paper (mounted over a cartridge paper backing to soften the stroke), the work of the draftsman felt more personal, more subtle. One could do the whole process with one tool. Light construction lines ghosting out the drawing followed by a firmer stroke especially at the start and end of each line while rotating the mechanical to keep the point sharp. With pencil, not only was drawing faster, but the sheet of paper acquired a texture and would reflect the hand of the author more directly. One could tell the draw-ings by the manic, rushed architect chasing construc-tion site deadlines from the subtleties left by the reflective architect. These were the tools of our trade.

It is worth defining what kind of plans we are looking at. In German, plans refers to all the tech-nical drawings leading to construction whether horizontal or vertical. In English, the plan refers specifically to a horizontal section while the whole set of construction documents, including plans, sections, elevations, and construction details are commonly referred to as working drawings. Add-ing the verb working lends a particular kind of technical and ethical purpose. These are not objects of contemplation, of aesthetic quality of their own; they are work and they represent more work to be done. They may be seen as a means to an end and nothing more. But of course this has never been entirely true. The architect has always invested in the working drawing with more than pure information and data to share with builders. Either deliberately or inadvertently, the working drawing is laced with conceptual and ethical values underpinning the architecture. The architect's plan combined both everything that is common to the language of architecture, its traditions and conventions with what is personal and unique like a form of handwriting.

As a student, Peter Zumthor’s drawings of Saint Benedict Chapel in Sumvitg Switzerland (1989) published in the Architectural Review in 1990 were particularly memorable for the com-bination of precision and atmosphere [p. 5, 149]. These were not black lines on white, they were shades of grey lines on grey background. I had not seen the building (and still haven’t to this day) but I’ve also believed that the qualities of those draw-ings would be found in the building, regular but sensual, austere without being cold. Like many students, I had fairly promiscuous architectural taste and studied Frank Ghery’s early work with equal enthusiasm. One doesn’t need to travel from Switzerland to LA to find the difference between Zumthor’s and Gehry’s timber buildings. Al-though working predominantly with softwood frames, their construction traditions and inven-tions couldn’t be further apart and their working drawing technique draws out the difference. Both working in pencil, Zumthor’s drawings are above all complete works in their own right. The mise-en-page perfectly places the subject on the page. The layers of overlapping lines; from barely visible grid lines to the heaviness of elements cut by the imagined section to the regularity of the hatching, speaks of patience, resilience. Nothing is left to chance. Tolerance has certainly been considered, but this is dimensional tolerance, technical toler-ance where it is required by the material that masks another kind of intolerance. Every element in the architecture has been considered and honed. Mistakes do not form part of Zumthor’s arch-itecture. In LA, however, all of Gehry’s lines are broadly equivalent, democratic, even careless. The drawing shows what is necessary and no more. There is no time for hatching. This is not a meditation over reduction and craftsmanship, it is fast, intuitive riffing on well-known commercial vernacular. The notation and construction is eco-nomic, even expedient. The results, refreshingly direct. There is plenty of tolerance both dimen-sionally and also morally, allowing the carpenter to complete the task according to prevailing rules of commercial construction. Gehry’s working draw-ings are loose and opportunistic. But one shouldn’t be deceived into believing that these drawings suggest lesser importance to construction. On the contrary, bothshow a deep knowledge of construc-tion, materials, and a wider socio-economic context. Gehry’s apparently laconic plans embody the tradition of American timber framed construc-tion just as profoundly as Zumthor’s drawings suggest the craftsmanship for which he and the Swiss are so famous. The drawing is not only a means to an end, it also suggests the means.

When I completed my studies in 1997, long after these buildings were completed, the craft of architectural draftsmanship seemed as use-ful as calligraphy. Georges Perec opens Species of Spaces with “This is how space begins … signs traced on the blank page”1; but today such direct, unmediated creation is no longer possible. To-day, paper is the final resting place for the line after a life of digital gymnastics. Layers, classes,
attributes, nurbs\(^2\); so many decisions before space can begin. The stroke of the pencil or pen has been replaced by the click of the mouse, the rectangular expanse of the drawing board by the infinite zoom of the screen yet the orthographic projection of the plan remains the lingua franca of architecture. The plan is the thinking and the letting go, the conception and the communication with the maker, taking the architectural imagination into the world line by line. Although it is no longer drawn, in the original meaning of the word, to pull a pencil across a surface, the plan retains a uniquely autonomous position in architecture between the architect and the built architecture. The great conceit of the plan, to imagine the work of architecture sliced horizontally or vertically to reveal simultaneously its solids and voids, its surfaces and nodes is an improbable but powerful abstraction. After the point, the line is the most basic Cartesian form, yet it is capable of representing, in the context of the plan, a multitude of constructed spatial ideas. The line may represent the physical and the abstract; it may suggest a surface, a gesture like the spread of a trowel or an invisible legal boundary. The line can suggest changes in the states of matter between mass and void or between a liquid and its container. The lines coming together to make the working drawing may be yet more mysterious containing a temporal dimension representing both the pre-existing, part of an ancient structure and also the as-yet unrealized anticipated future. The drawing contains a latent architectural order; densely layered or monolithic, dotted to float above or thickened to suggest the imaginary slice through plaster, steel, or concrete. The plan is the making of the architecture. It is the instrument by which the architect records what is found and proposes what will come. The plan is the means of conception and communication. In the end, the plan is not so much musical notation or handwriting as it is the fingerprints of the architect, both universal and unique. More than the sketch, which communicates intuition and first thoughts, the working drawing bears the imprint of the whole process, through to every decision whether invented or imposed from the outside. The working drawing contains the sum total of the architect’s thinking, time spent, compromises, imagination, and skill synthesized and distilled in lines on paper.
As architects, any drawing we produce serves as a means to explore and communicate ideas. In our studio, drawings are generated to explain concepts, to transfer thoughts onto paper in a more tangible form. Later, sketches are used to support conversations in which initial ideas are subjected to critical dialogue. Invariably, through discussion, drawings are modified and adapted. Often the best drawings are those generated in an attempt to explain or clarify something in the course of such conversations. The process of proposing and revising extends throughout the life of a project, and beyond the moment when it is inhabited. Drawings are sometimes strictly two-dimensional—plans, sections, or elevations—but most of them work with depth, trying to represent a form or a space. While this type of project development is an established working method, the most consistent form of production for us is a plastic one. We produce models in order to develop and understand projects. At a certain point drawings are used to communicate a project to a client, and later to statutory organizations. Later still, we formalize the way we draw to comply with conventions. In this way, drawings communicate our intentions to those who need to interpret them. We do not produce working drawings for our clients, although they service their needs, but for the many people who contribute to the building process.

When we opened our architectural studio in 1996, Stephen Bates and I worked alone and drew everything ourselves. At the time we could not draw on the computer and, incidentally, we still cannot. We had learned the conventions of drawing in the offices we had previously worked in, and when we started on our own we agreed on a way of drawing as a reaction to this shared experience. At the time, we produced construction drawings on tracing paper or film and drew with ink pens. These drawings were the product of a lot of work and we have kept them safely. While computer drawing has changed the way the office produces information, Stephen and I still draw by hand. I notice that our assistants treat our pencil drawings with a degree of ambivalence, simply because they are so conditioned by the possibilities of digital reprinting. They are aware that each hand drawing is unique, but do not fully appreciate that it can never be reproduced exactly, unlike digital drawings, of which it is possible to print infinite copies.

Drawing by hand offers certain possibilities that do not exist in digital drawing. A hand drawing contains a sense of doubt and represents an attempt to work things out, that which we value highly. It contains a level of inaccuracy that is closer to the reality of building. A computer drawing has the capacity to represent a level of precision that is rarely possible in construction. With a hand drawing, every element has to be scaled. A repeated element has to be drawn again and again and, like the modules that are actually built, it is, in reality, never the same.

In 1996 our first employee Mark Tuff joined our practice, and later became our partner in 2008. Among the many skills Mark brought to the studio was an ability to draw on the computer. Today everyone in the studio draws by computer, with the exception of the senior partners. In the late 1990s the three of us would produce the working drawings for our buildings by being "specialists" in specific kinds of drawings. Mark would typically produce the general arrangement drawings at either 1:100 or 1:50 scale. We understood these as strategy drawings that explained the overall intention for a building. These were the drawings that enabled a building to be set out and measured.
Stephen tended to concentrate on the detail drawings, at a scale of either 1:1 or 1:5, which explain how the strategy for a building is to be realized in detail. I would generally concentrate on drawings that sit somewhere between strategy and detail, and these would often be 1:20 or 1:25 sections through a building. As they were drawn by hand, this scale would allow for enough understanding of the layers of construction and the elements of a building. These drawings would also indicate the position of key details within the overall design.

On reflection, this was a very efficient and tightly coordinated way of working. We always knew what everyone else was doing, and the development of a project involved a constant process of discussion and refinement. What I am describing was by no means original at that time (the late 1990s), but it was representative of a particular attitude to developing a project that made sense to us. This method became established as a way of working that we still use in our studios today. The introduction of digital technology has undoubtedly brought changes, but many of the conventions of our working drawings originate in the manner in which we used to draw by hand.

Today I realize that the way we draw in the studio is particular to the manner in which we choose to communicate information. All architectural practices reveal something of their own culture and position in the way they produce working drawings. Ours are not necessarily produced in the most expedient way, and we even take some pride in the way they are made. Drawings are on display in the studio, particularly at the stage when a project is developed prior to going on site. Over many years we have devoted a considerable amount of time to refining and making our drawings more legible. By trial and error we have tested the legibility of drawings at different scales, experimenting with different line weights, techniques for hatching the elements of a section, and trying to convey material qualities. The graphic designers Cartlidge Levene have also contributed to this process, and we developed our title block and graphic identity in collaboration with them.

One aspect of drawing that particularly concerns us is the management of dimensional information. The numbers we put on a drawing have great contractual and legal significance, but they are also linked to an issue that interests us greatly, namely, notions of tolerance in building. As architects we have learned over time the importance of being able to judge the demands of the construction process. This needs to be considered in relation to program, budget, contractual framework, geography, and local building culture. Put simply, it would be illogical to demand a high level of craftsmanship for a low cost housing project with a Design Build contract in a remote location. This is not a straightforward issue, because whatever the circumstances, numerous judgements need to be made that prioritize areas where a high level of control is necessary, over others where it is not so important — or indeed appropriate.

This must be taken into account when adding dimensional information to a drawing. We need to think carefully about the level of accuracy stated and ensure that it is reasonable, or even possible. Sometimes we need to remind our assistants that the computer determines a level of accuracy that is not possible on site. No two bricks are ever exactly the same and therefore the setting out of a brick wall needs to take this into account. We also avoid dimensioning all the increments of a plan if the overall dimension is given, as this often leads to errors. It is better to leave at least one increment out and rely on the people responsible on site to work things out.

Tolerance as a concept has a greater significance than focusing on accuracy in construction. It is consistent with openness to historical legacy and receptiveness to the lessons old buildings embody. While they cannot meet the demands and needs of contemporary architecture, we are increasingly turning to pre-modern examples for inspiration. The more we build, the more we appreciate the humbling achievements of masons and architects, known and unknown, from different eras.

A final, but important point: working with tolerance does not come at the expense of quality. A drawing considers and accepts tolerance, but it still needs to be a good drawing. This small but crucial component represents the architect's hope to excel, within a realistic reading of the opportunities a project might offer: it is a judgment that must be made case by case.
At some point in the early 1960s the American philosopher Nelson Goodman came to the conclusion that not all arts are equal, and a crucial difference exists between autographic arts, where artists make their own works, and allographic arts, where artists script works that must then be performed or executed by others. Allography is in some cases a practical necessity: as no musician can play one hundred instruments at the same time, a symphony must be scripted so a whole orchestra can perform it. The composer may still direct it, but the musical score is supposed to function even in the absence of its author—for example, after her or his death. The main purpose of such scripts or notations, as Goodman called them, is to convey the same instructions to all, at all times, and without ambiguity, so the executed work of art will be just what the artist had in mind, even when the artist is not there to illustrate or explain it, assisting and instructing each performer in person.

Notational arts famously require a great amount of learned skills from all parties involved. Everyone today is more or less familiar with the thousand minute signs that populate a musical score, but many who did not study ballet at school are often surprised to learn that the infinite seamless movements of a solo dancer, or of a whole corps de ballet, can be almost as precisely recorded and enacted from script—using either the Laban notation that Goodman was familiar with, or others.

Goodman appears to have been less interested in architecture than in other arts—his wife was a painter, and he himself was mostly interested in the performing arts, as well as being a noted and quirky art collector. In his book on the theory of art languages, first published in 1968, he briefly remarks that although modern architecture is mostly executed from blueprints and other construction drawings, modern buildings are so complex that they can hardly be built entirely from notations, or allographically—thus suggesting that, when building, so many things can happen and so many choices must be made that no drawing, however rich or complex, can hope to include or anticipate them all. No architect who ever tried to build will disagree. Indeed, throughout most of its history, architecture was not a notational art at all: in antiquity and in the Middle Ages buildings were made by craftsmen—and in the Middle Ages, by free craftsmen, or guildsmen—who, like artisans of all times, were expected to think and invent, solving problems and finding solutions often on the fly, within the ambit of a loosely defined building program. In the fourteenth century, no gothic vault could have been built from drawings—first, because no construction drawing of the time could have explained how to cut stone in 3-D; second, because, not surprisingly, medieval stonecutters did not use scaled drawings to learn or practice stereotomy. Even though exceptions must be made for Greek and Roman classical building (where some identical shapes, profiles, and moldings were reproduced on site from full-scale templates or 3-D mock-ups), most pre-modern architectural drawings were used to communicate some visual aspects of a building to clients, commissioners, or to the general public, not to convey technical aspects of the buildings to the workers who would build it. Indeed, today’s construction drawings, a notational tool for the conveyance of technical information from designers to makers, are a modern cultural technology (Kulturtechnik) invented by Leon Battista Alberti in his treatise On Building (De Re Aedificatoria), composed around 1452.

For it is around that time that Italian humanists of the early Renaissance thought that buildings should no longer be made by artisan builders, but
by a new kind of artist and thinker, of which Alber-
ti saw himself as the prototype. Unlike the medie-
val master builder, the Albertian architect does
not make buildings; he just makes drawings of
buildings—in Goodman's terms, notations. When
the drawings are finished, they are sent to the
workers. They do the actual work—they cut stone,
lay bricks, and saw timber. In Alberti's famous defi-
nition (De Re Aed., I,1,2), architecture is conceived
in the mind, expressed through drawings and
models, then executed—but executed by others.
As a corollary to this principle, the architect's
drawings must be complete and exhaustive, and
must contain nothing more and nothing less than
the physical building in its entirety.

Alberti’s novel way of making is in many ways
a foundational paradigm of modernity: unlike the
medieval craftsman, who was a maker and thinker
in one, the modern thinker is not allowed to make,
and the modern makers are not allowed to think.
Design, not making, carries all the intellectual
added value in the modern world: thus a car is an
act of design, and it is owned, intellectually, by the
designers who invented it, not by the workers, and
increasingly by the robots, that manufacture it.

Today, not only pharmaceutical drugs, but even
soft drinks and cookies are acts of design—they
exist first and foremost as formulas, or notations,
irrespective of the factories around the world
where Aspirin, Coca-Cola, or Butterkeks are mass­
produced, paying royalties to their respective
authors and intellectual owners. In architecture,
construction drawings are the keystone of this
new way of building, and the indispensable vehi-
cle and tool for its implementation. For the Alber-
tian paradigm presupposes that the entire build-
ing, as built, should be the identical materialization
of an act of design that must have been fully and
entirely expressed by the author’s original nota-
tions. If something went amiss or was added be-
yond the author’s original script, then the building
is no longer the result of that design, and the de-
signer is no longer the author of that building. In
short, let only one discrepancy occur between the
author’s idea and the building as built, and the
whole system breaks down.

Alberti knew that his whole theory of design
was dependent upon functioning notations—
drawings that designers could safely use to com-
municate with builders, and which builders could
understand and would abide by. He also knew that
no such drawings existed at this time, hence he
insisted that designers should only use a particu-
lar kind of picture, which today we would call or-
thographic: scaled drawings in plan, elevation,
and side views (De Re Aed., I,1,4). Unfortunately
parallel (Mongeian) projections did not yet exist
at the time, hence Alberti could not provide a simple
geometrical definition for his new format of archi-
itectural notations. Moreover, Alberti soon found
out, to his detriment, that no construction worker
of his time would build by notation—i.e., following
the drawn instructions sent in by a remote and ab-
sentee designer. That was simply not the way of
building at the end of the Middle Ages, when work-
ers mostly did what they were told to do by some
one who oversaw them on site and in person. To
that end, oral instructions and viva voce argument
was all that was needed—supplemented by con-
tracts in writing when monies were at stake.

It took a few centuries, as we know, for Alber-
ti's paradigm to be fully accepted, both technical-
ly and socially. Today, Alberti’s paradigm is the
basis of the architectural profession around the
world: It defines architecture as a global art of de-
sign, and is enshrined in the laws and customs of
almost all countries—including many that never
went through a Humanist revolution. With it, the
original paradox conspicuously inherent and em-
bedded in Alberti’s theory has equally pervaded
the theory and practice of all modern arts of
design. For it is evident—as it must have been to
Alberti himself, and as it still was to Nelson Good-
man half a century ago—that no construction
drawing, no matter how rich, can ever hope to en-
capsulate all aspects of a physical object yet to
be built.

Alberti was a visionary, and his theory was
the expression of an overarching intellectual am-
bition. As such, it has changed the history of build-
ing in the West—and more. But if we translate that
intellectual agenda into legal chapter and verse,
and into the nuts and bolts of an actual design as-
signment, odds things start to happen. If a build-
ing—any building that was built by design, and
designed by notation, in the Albertian, Western
way—must be the faithful copy and execution of
its author’s drawings, that means that every atom
of that building must have been notated by its de-
signer. Every atom? And if that does not seem prac-
tical, where should the designer stop? Should
the designer choose the door knobs, the Venetian
blinds, the glass of the window panes, the color
of the carpets, the model and make of the electri-
cal outlets? And if not the designer, who else?
A designer could argue (and some have) that if
you change the specifications of the glass in the
windowpanes of a curtain wall façade, the build-
ing will no longer be the one she or he designed.

But which kind of construction drawing can indi-
cate the architectural qualities of a certain make of
tempered glass? For that, other instruments
should be used, as indeed today they often are. In
short, the ontological gap between design inten-
tions, their notation through construction draw-
ings, and their material implementation leaves
an inevitable grey area of undecidability, argu-
ment, frustration, litigation, and liability where all
kinds of ad-hoc personal interventions, approxi-
mations, improvisation, bullying, persuasion, im-
pirations, machinations, and subterfuge take the
place of construction drawings and specifications,
and haggling becomes the design instrument of
choice.

Some star architects can, famously, control
even the most minute aspects of a building—Mies
vander Rohe was a case in point. In the case of the Seagram building, one feels that Mies's office (in that instance, through the complicity of Phyllis-Lambert, Mies's inspired patroness) might as well have designed the haircut of each uniformed doorman standing at the entry. Most practicing architects, however, do not have such power, and they can only maintain some hold over the endless minutia of actual building at the cost of a never-ending, titanic daily effort, which evidently contradicts both the spirit and the letter of the Albertian program: if all aspects of a building can and must be inscribed in a set of construction drawings, then, when the drawings are sealed and sent, the game should be over. Yet as we all know, that game is never over. Construction drawings are testimony to this paradox and conflict, and their opacities and ambiguities are the living proof of the original sin, so to speak, of the Albertian project, and of its indelible legacy: we make drawings to design things we know no drawing can and will ever control.

In recent times, this Albertian paradox has migrated from paper to electronic media, and one of today's most powerful tools for computer-aided design, known under the generic name of Building Information Modeling, or BIM, was developed specifically to facilitate the exchange of information between designers and makers. The spirit of BIM posits that designers, builders, and theoretically other agents as well, such as customers or clients or users, should participate in the collaborative making of the digital model of a future building, and that contractors, in particular, thanks to this new, interactive digital platform, may step in the design process from the very start, thus bridging the gap between design intentions and their execution. Phillip Bernstein of Autodesk has recently suggested that this new participatory way of building invites a new business model as well as a new legal framework for project delivery, where authorship may no longer be the privilege and monopoly of traditional designers.3

Given the unprecedented power of digital simulations, one may surmise that at some point virtual models may become perfect duplicates of, and substitutes for, the buildings they represent—embodying and enacting all and every aspect of them. Their designers could then make a digital model just as builders would once have made an actual building, and the final translation from model to building would entail no intellectual (or informational) added value whatsoever. As in Borges's famous paradox of the map that becomes identical to the territory it portrays, this final culmination of the Albertian notational paradigm appears ontologically problematic. Time will tell. Meanwhile, regardless of the notational tools we use, physical or digital, the Albertian paradox will most likely live on for a while—and with it, all the messiness, uncertainty, and drama that the notational way of building has engendered throughout the history of the design professions.

The building plan for the "Large Hadron Collider (LHC)" [\(^{+}\text{p. 209}\)], printed on a common paper format, looks like a depiction of a microscopic particle. In reality, however, it is a drawing of an enormous machine that is part of the particle accelerator at the CERN in Geneva. Various research groups use the LHC to measure reactions in the decomposition of atoms that are being shot at one another at nearly the speed of light. This is meant to enable the decoding of answers to the remaining open questions in the long-term standard model for elementary particle physics. While a building plan usually shows how to realize an architectural idea in built matter, the plan for the LHC is a special case. This experiment aims, for its part, to decode another building plan: that of the universe, which according to the popular big-bang theory is meant to have arisen in a fraction of a second.

The common building plan is the connecting link in the communication between the architect and the tradespeople implementing a project. In the tender drawing, the architect defines the design intentions for the materialization and detailing of the structure and individual building components. The firm or tradesperson draws the working drawing based on these parameters, which are then checked and cleared for realization by the architect. Until into the early twentieth century, within the individual trades, nearly all of the construction details could be realized in the workshop based on the architect's idea. With the development of the assembly system in the twentieth century, the construction of buildings based on the architect's prototypical plans came to a creeping halt. Today, the issue is the selection of the system used by a firm, which must guarantee the firm loss-free execution. The architect can only more or less painstakingly control the planning of details, which is carried out by the construction firm.

The current status of the building plan arose over the course of a development lasting centuries. The first stone drawings that could be interpreted as possible building plans are from the era round 2,500 BC, when drawings of a building site were chiseled in statues in Lagash (Mesopotamia). They depict a building projected onto a surface in conjunction with a graduated scale and a reference tape.\(^1\) The cornerstone for the state of today's building plans was laid in the sixteenth century, when the job of the architect began to diverge from that of the master builder. Knowledge at the building site was no longer passed on orally, on site, but instead, by means of drawn documents for construction, which the architect prepared off-site.\(^2\) From this moment on, it was necessary to develop documentary aids to realize an architectural idea at the construction site. Such documents are for the negotiations between architect and implementing tradesperson, and provide, to a greater or lesser degree of detail: dimension, proportion, material, and the joining of the elements at a constructional level. This basic technique has been continually further developed until the present day. Scale was consequently introduced for various stages of detailing, and detail drawings were developed for various categories of buildings. Dimensioning and legends are now standard for every building plan, and in recent decades, also legal text content has become standard.

This layering of complex information in a visual depiction has led to plans of an extremely high aesthetic quality. The examples in the building plan collection selected here are mainly from the twentieth century, from a time before the pragmatic change to computer technology took place. For the bell tower of the chapel in Sogn Benedetg, Peter Zumthor created a colored-pen drawing...
A technical drawing. The chain dimensioning describes the precise proportions of the cross-beams of the tower. Glenn Murcutt's section for the Simpson-Lee House brings together in a single drawing nearly all information that is necessary for the creation of the building. The descriptive text becomes a crucial element of the plan. One could even claim that here, the text format is accorded the same status as the graphic element. Beginning in the 1970s, the technique of hand drawing came to an abrupt end. Within just a few years, the computer nearly totally replaced the drawing board. However, in most cases, the digital plan still rested on a graphic base, even though computer technology offered entirely different possibilities when data could be tabulated in text form and made interdependent.

Digitized and industrial architectural production began already in the 1950s. Post-war structures were designed to be built in individual elements in factories and compiled on the building site. At the same time, these concepts also allowed for simpler renewability in that building components could be easily exchanged when they became obsolete. Also the first computer programs for architects originate from this era: At the Massachusetts Institute of Technology (MIT), Ivan Sutherland developed the first interactive graphic program for the representation of architectural drawings in 1963.

The post-war era buildings failed in their conception and must now be demolished or painstakingly reconstructed as icons. Nonetheless, they mark the starting point of a development in construction history that saw the questioning of classical building processes. Nowadays, “digital fabrication” is being explored at a new level. Various approaches with building robots and the first attempts at constructions built by means of flying objects have led to construction technology in which an architect’s digital information, that is, a digital code, directly controls the performing machines. In this, data and material, programming and construction, become one whole.

The fundamental idea of constructing by means of elements and their joining corresponds with a digital way of thinking. In the future this will enable the integration of engineering concepts and principles in the early stages of architectural (design-)work.

Thinking ahead in terms of this development, the building plan as a means of communication between architect and tradesperson will become an obsolete instrument, since mediation between the two professions will no longer be necessary when the transformation to matter is carried out by a machine and the machine’s transformation code is written directly by the architect. On the other hand, the person who is programming (the architect) will have to understand a great deal more about the material and technology of construction. Thus, more than the production technology, the job professional will change and the drawing architect will again become a designing engineer.

In certain areas of the building industry, digital prefabrication and production of buildings and building elements has already generated applicable technologies. This development is furthest advanced in timber construction. Here, the application of CNC machines has largely become standard. Entire building elements are prefabricated in the workshop by means of CNC beam facilities and installations are already built in at the factory. Nonetheless, the so-called “digital chain” still rests on the standards of conventional planning processes. The building plan is produced by the architect and tenders are invited for the works. Only after the awarding of the contract are the building parts re-plotted based on the firm’s software and programmed for production. The digital chain thus operates within the producing firm. It is used to denote the activities within digital production: the elements to be produced are drawn on a CAAD program. Afterward, they are translated into the software language of the production machines via CAM-Software and produced through these so-called CNC-machines.

In a visionary building process, the machine code would already be written by architects/project authors, and the data processed directly by the producing machine. However, for these procedures, the required technology standards currently do not exist. The firms that operate large CNC production sites in Switzerland, for example, can be counted on one hand and they all have individual processes of work preparation and technical realization. The project author therefore has no chance to generate production codes before the awarding of the contract, especially since the individual firms rely on certain production secrets.

While the standardization of CAM and CNC technologies still lies in the distant future, for quite some time the planning world has been making efforts to create a general interface for integral building models (BIM®). The so-called “ICF-Format” has been more or less acknowledged as a standard for a while now. This format makes it possible to program the information about architecture, statics, and building technology and exchange it between different types of software. With this, three-dimensional geometric data are not only depicted, but simultaneously linked with tabulated secondary information about the individual elements and the relationship of the elements to one another. In the end, this enables control of the currently very complex factors of a building at every phase of its design. Production costs, maintenance costs, and, for example, technical specifications for fire-protection, can be controlled and optimized at all times.

Of course, any architect who stakes a claim to creativity dismisses this idea. But it could possibly present a future scenario that is capable of answering technical questions more efficiently, thereby generating more time for creative issues.
The lengthy history of the development of standards for the building plan in effect today shows the complexity that is found in these documents and that must first be developed for digital processes and manufacture. Furthermore, it has been shown that in light of the high complexity of the material in this area, specialists are not promoting the goal of integral digital building production. Everyone does research in their own individual area. Although the goal may seem unreachable, development is nonetheless leading to the automation of as many planning and completion processes as possible. Perhaps things will proceed somewhat like the research conducted at CERN on the Higgs boson, which was most probably discovered during experiments in the LHC in 2012. Also with this discovery, the scientists involved in the basic research are still unable to designate a specific use for humanity, even though here, talk is of the discovery of the century in theoretical particle physics.


The architectural drawing—as handed down to us through Vitruvius's descriptions, but also earlier, actually surviving examples—is always an attempt at abstraction and representation: it mediates an architectural concept, provides building instructions, or documents an already built reality. An architectural drawing always simplifies the building concept; it reduces and idealizes, aims at effectiveness through both projection and reduction in size, creates comprehensibility through codifications of materials and geometric principles (sections, ground plans, scale), and transmits the complex and inventive realities of historical architecture across time.

The challenge of an architectural drawing is to combine density, clarity, and complex information with utmost "objectivity," or rather, an independent representation. All this enables legibility across time and cultural context. As a virtual artifact, an architectural drawing is, admittedly, never independent from the production process; and the ideal drawing would not conceal this. Rather, it would reveal its aesthetic program while providing leeway for interpretation and the implementation of details.

During the seventeenth century, several forms of architectural representation became canonic: the sketch (not to scale, and not necessarily orthogonal, thus not always conveying the idea of a final product); the elevation; the ground plan; and the section (drawn to scale, and regularly orthogonal); and the working plan (drawn to scale for the building site and showing details and the construction methods of different structural elements). At the beginning, these architectural representations were used equally by mechanical engineers, civil engineers, and architects. Based on descriptive geometry, these representatives of the polytechnical tradition developed a uniform, binding, and in part also three-dimensionally-legible language of representation. Even time specifications were defined in what may be called "plan scripts," as shown in Diderot's and d'Alembert's Encyclopédie of 1772, containing instructions for fencing and dance, which establish movements in space as temporal concepts.

Early on, cartographers Thematized problems of precision and abstraction, as Borges's wonderful narration on the "Exactitude in Science" impressively demonstrates (Borges developed the idea of a factually precise and therefore impractical map at a scale of 1:1; see fig. 2). Soon, mechanical and civil engineers began to use additional formulas and abstract terminologies for the representation of material qualities and movements. In architecture, the old principle of orthogonal-graphic representation (site plan, elevation, section, ground plan, constructional details)
The difficult survival of plans

The history of building has left us with an impressive corpus of architectural drawings—ancient working plans for the realization of columnar entasis (outward bulging), for example, were found carved in the walls and floors of structures. Clay panels with plans survived from the Assyrian era, papyri from the Egyptian, and architectural models from Roman times. The precision of actually surviving structures makes it evident that specific graphical and mathematical analytical tools were used for their construction process (for example, structures that were built according to the position of the sun; or structures featuring spatially complex architectural members, such as the Tower of the Winds in Athens). Both the designs for the Romanesque monastery in St. Gall, and Gothic drawings for churches have survived on animal skins. However, new systematic concepts for designing, engineering, and controlling the construction process were not developed again until the Renaissance, with the systematic re-analysis and the re-documentation of ancient structures. Theories replaced the handing down of implicit craft and construction knowledge. Land surveying, the encyclopedic collection and mediation of new "building disciplines," as well as their anchoring in science and historical development, led to the creation of resilient principles of abstract geometrical representation while advancing the development of older codes for architectural plans.

The period of the unique copy and its technical limitations: paper formats, writing instruments, colorants

It is a long-standing tradition of both building research and art history to publish historical plans with indications of paper format and scale. The dimensions provided in the catalogues of eighteenth-century-plan inventories shows us how the availability of handmade paper also influenced the possibilities for plan views. Most sheets measure around 30 cm, and it is rare to find formats larger than 50 x 60 cm. The dimensions of individual sheets vary considerably and some sheets are glued together and lined on the back with linen cloth. An instructive example is Schloss Bruchsal’s early plan collection, which documents the planning activity of a prince-bishop’s building office during the eighteenth century. While the collection preserves only one single (folded) working plan with traces from its use on the construction site (fig. 5), it contains a great number of design sheets (fig. 6), and plans that document both the design process and the mediation of the project (fig. 7). Before the development of oil paper, which made the copying of architectural drawings somewhat easier, building plans were original drawings or elaborate
copies, which were first transferred from the original by means of a measuring compass and then newly drawn. Sometimes, one can find under the ink lines on handmade paper, the preparatory graphite and pencil drawings, which sometimes show earlier stages of the planning process. Often, the eighteenth-century plan was also colored by applying a wash to indicate sections of wall surfaces in gray and pink hues; the architect's box of watercolors contained mainly red varnish, vermillion, lead red, yellow, red, ochre, massicot, gamboge, gray, and umbra, along with Prussian blue, indigo, ultramarine, litmus, and mountain blue.

As of yet, a systematic examination of the master builder's painting and drawing utensils has been established for only very few historical plan collections. In 2012, the exhibition "Karl Friedrich Schinkel. History and Poetry" featured a remarkable showcase entitled Schinkel's Papers—a phenomenological documentation of the new technical developments during the early nineteenth century: for example, visitors became acquainted with the then newly introduced blue watercolor and learned about the attempts to develop smooth and uniform paper for watercolors; different inks for plan drawings and labelings were shown (and how they aged), as well as drawing pens and steel pens, colorants, and techniques of paper production. Much more so than during the late eighteenth century, the Schinkel era was concerned with the painterly-visual integration of architectural representations into vedute and the large image: the interfaces between three-dimensional illusion and perspectival drawing were newly explored in panoramas and theatrical stage paintings. Since the mid-nineteenth century, competitions provided new challenges for the architects' skills in visual representation. Far more than during the eighteenth century, the Schinkel era produced richly detailed and colorful proposals for décor and furnishing: now, the image of the surface stepped to the foreground of an ambitious drawing.

Of course, the Bautforscher-architect of the early nineteenth century also always drew the overall situation along with the columnar orders: the sheets (for example, the garden at the Lysicrates-monument, as drawn by Stuart and Revett) always showed, in addition to instructions on the structural relationships of individual architectural members (partly abstracted through proportional relationships), the overall idea of the building and a representation of the context; in other words, these reconstructions combined the documentation of historical reality with a suggestion for its ideal abstraction. However, until the end of the nineteenth century, the number and variety of sheets depended on:

- The possibilities of the hand drawing,
- The limitations of the material, and
- The limitations of duplication, and of copying processes.

Scarcity of means and limitations of reproduction In transferring information, the architect of the nineteenth and early twentieth centuries relied on variety—he collected and reworked templates from printed works, made sketches of buildings, and kept travel diaries. The information collected in these diaries flowed into his design and working drawings; and, as in the eighteenth century, measuring and documentation were at the beginning of a project; they were the point of departure for all further building considerations. In the nineteenth century, fold-out sheets with alternative detail solutions were frequently glued onto larger, often colored sheets, which contained design variations and explained preliminary planning stages. Unique drawings and plan copies were used to communicate planning decisions, and printing techniques conveyed standard solutions to a larger audience. Beginning with the works of the Berlin architectural painter Wilhelm Zahn, lithographs reproduced ancient finds and new architectural pieces in color. In Schinkel's work, lithographed color plates appeared in the 1840s. Sep- mper added colored plates to his Style in the Technical and Tectonic Arts in the 1860s; and there are also scattered color illustrations in the Handbuch der Architektur, for example, in Josef Durm's volumes.

A peak and simultaneously a crisis in the art of plan drawing occurred towards the end of the nineteenth century: the forms of representation as well as the techniques and methods of construction had been mastered superbly, and many new construction inventions were available. It was now possible to integrate technical aggregates into buildings, such as steam heating, sanitary facilities, and lifts, which required specialist knowledge. The scope and variety of building tasks, perfectionism, and professionalism necessitated the production of elaborate plans and architectural representations. At the same time, professional interfaces with engineering and other specializations became more challenging.

Architects' offices (which, at the time, became more and more private companies, and for the first time independent from the state as client) responded to the changing situation with a variety of strategies:

- Attempts were made to accelerate and automate the process of creating plans and drawings;
- Simple printing techniques were tested for the duplication of important plans;
- And ultimately, a system for the reproduction of construction drawings was developed, using blueprint and later photo-print processes as well as tracing paper.

In the following, we will take a closer look at the automation of drawings and the development of a specific phenomenon—the utopia of the automated hand-drawn plan.
Automation of the drawing technique and copy method in plan production around 1900

It was not until the mid-twentieth century that drawing techniques and the development of new tools intervened fundamentally in the basic issues of knowledge transfer between architects and practitioners. Since the turn to the twentieth century, attempts had been made to rationalize drawing processes, leading to changes in the division of labor and also, the systematization of processes. The concept of a (computer-aided) process chain of construction and the automation of production would subsequently fundamentally transform the building plan's character.

In early-nineteenth-century reference books, initial steps toward regulating and standardizing architectural drawings were still formulated in a very cursory way. Crosshatching and colors should be used economically in building plans, and only if they did not harm clarity. Both the means of representation and the function of crosshatchings and colors were left to the draftsman. In 1887, Alfred zur Megede published *Wie fertigt man technische Zeichnungen?*, an early systematic guide for standardizing the means of representation in technical drawings. Benkwitz’s *Die Darstellung der Bauzeichnung* followed in 1888; it was an official manual for the creation of architectural drawings in the German-speaking area. Supplemented with colored lithographs and based on the earliest standards established in the engineering disciplines, this handbook provided rules for scale, detailing, and color coding—all of which remain, for the most part, valid today [fig. 10].

The industrial production of instruments

The History of Technical Drawing by Franz Maria Feldhaus provides a good overview on the origins and development of architectural tools up to the mid-twentieth century. The industrial manufacture of compasses provides a showcase for the transformation of the tool industry during the late nineteenth century. In Chemnitz, the watchmaker Emil Oskar Richter began developing mechanically produced drawing instruments, thus abandoning the tradition of the handmade “Swiss compass.” The new “flat system,” with its straight, square legs and exchangeable needles could be produced with a milling machine and was therefore more economical; another advantage was that the user could quickly change needles. The industrially-produced, disposable needles provided great precision and minimized the number of punctures—as evident in the plans from this era.

The parallel ruler was replaced by a drawing table equipped with a protractor T-square, thus allowing "lines and points ... to be made with greater accuracy." This set-up was the precursor of modern drafting machines. Drawings in the "black-line-mails" could now be achieved faster with the help of a number of "apparatures constructed for this purpose." The greatest effort in crosshatching is to maintain a steady, regular space between individual lines ... the slightest, even singular irregularity in the distance of the lines immediately becomes noticeable to the eye of the beholder in a displeasing way. In order to accelerate the crosshatching process, the rolling parallel rule was developed; the draftsman simply had to draw a line along its edge. With the cross-hatching ruler—also a patent by E. O. Richter—a simple push of the button was enough, and the T-square moved the desired distance [fig. 11].

Not only inventions, but also the further development and the refinement of existing instruments were important for the drawing process: the drawing pen was critically improved through sophistication of the joints, adjustable screws, and sheet metal profiles. The increasing precision of standardized line widths resulted in a change of plan graphics—as easily recognizable in the floor plan in fig. 18. A patent drawing for a fountain-pen shows that already in 1864, creative solutions were being sought for drawing continuous lines across greater stretches: a drawing pen with an ink reservoir that allowed drawing without pausing for refilling. A dotting pen was also developed to allow a clean and regular dotting of lines—it was essentially a drawing pen with a small wheel at its tip, which applied the ink regularly by means of spikes on the wheel. For the same purpose, Richter developed another instrument: "the line to be dotted ... was drawn by a bow-type drawing pen, which was raised and lowered abruptly by means of a spring connected with a spiked-wheel." Different wheel inserts allowed the production of different types of lines: dots, dotted, and dashed lines [fig. 12].

The horizontal divider was developed especially for the division of brick walls at a scale of 1:100: "There is a small gear wheel attached to both ends of a little rod such that it is rotatable.
around an axis and removable. The circumference of the gear wheels is divided in such a way that ten or thirteen teeth equal the length of a centimeter.33 A simpler device consisted of a bundle of steel plates that was attached around a revolving pencil; when drawing floor plans at a scale of 1:100, this device facilitated "... setting out commonly recurring measurements of wall thicknesses as well as door and window openings."34 Architects also used more elaborate, so-called mathematical precision instruments. Due to their high price, these were employed mainly in the public offices of building authorities and engineers. The pantograph (fig. 13), for example, allowed drawing a copy by tracing the original plan to scale, enlarged, or scaled-down. With the so-called measuring counter, one could calculate lengths, and the rolling planimeter calculated surface areas by retracing their contours. Amster's mechanical integrator, a high-precision planimeter for the measurement of very small areas, such as on cadastral plans (fig. 14), or Coradi's mechanical "intergraph" were Swiss discoveries that were exported all the way to the United States.

Duplication techniques: the blueprint

The earliest duplication technique was the piercing of the original plan with a needle or dotted wheel,35 a method that is still prevalent in twentieth-century plan copies. The blackening of the original's backside allowed for a copy to be made without perforating the original; but here, too, the reproduction still had to be fixed and partially redrawn. The direct tracing of the original on transparent paper was made possible by the spread of light-sensitive oil paper or tracing paper, which allowed the direct production of copies with ink and watercolors. The introduction of the blueprint at the end of the 1870s brought mass duplication into architectural offices. The blueprint was the answer to the demand for a precise, simple, and inexpensive duplication procedure.36 After the discovery of light-sensitive iron salts and J.F.W. Herschel's invention of a liquid for fixing light-sensitive copies, the first usable blueprint was produced as early as 1842.37 The commercial distribution of the technique, however, occurred only in the late 1870s in Paris, when Marion & Co. began the manufacture and sale of light-sensitive paper.38

For the production of a blueprint, the transparency drawing was affixed to light-sensitive paper in a darkroom. Both the original and the copy paper were stretched in an exposure frame and covered. Before the availability of powerful lights, the prepared frame had to be brought outside to face the sun, and the covering was removed for a set amount of time (fig. 15). In a chemical process, the exposed areas turned blue, while the areas covered by the ink-lines of the above-lying original transparency remained white.

Even though new chemical processes later allowed the use of other colors, both the principle and the notion of the blueprint remain in use until today. In 1863, Poitevin and Pellet created the positive copy (blue lines on a white base), and Gustav Kögel's patenting of the diazotype in 1917 provided the cornerstone for the invention of the dryprocess and the success of the firm, Ozalid AG. From the final days of the nineteenth century until the 1930s, an entire industry was created around the reproduction of architectural drawings.

Disadvantages and limitations of the new duplication method

In today's architectural archives, the commercial spread of blueprints becomes apparent in drawings from ca. 1876. The number of plan copies seems to have increased significantly with the introduction of the blueprint process. However, the graphic editing of the blueprint copies presented new problems for the draftsman. Although the reproduction of lines was precise and inexpensive, the dark Berlin blue was utterly unsuitable for the color coding of architectural elements and building materials. Some plans39 show attempts to differentiate various elements by applying color with pens or crayons, however, in terms of legibility, these measures brought little improvement. Most likely, these limitations of the negative copy method accelerated the development of standardized and codified representations of crosshatchings and lines.

Beginning in the 1890s, a comprehensive use of specific crosshatchings can be observed on blueprints. In large-scale plans, the sections of wooden elements were now represented by wood grain, artificial stones by diagonal lines at a forty-five degree angle, and cement or reinforced concrete by dotted areas (fig. 16).

Automation of the building plan

In the early twentieth century, architects increasingly refrained from investing too much effort in complex elaborations of their presentation plans. Until the introduction of the blueprint, they compensated for the growing demand for precision and speed in plan production by developing faster drawing techniques and new drawing instruments. As a result, new line and crosshatching techniques began to replace hand-drawn, paintery work; at the same time, more information was included in the building plan (fig. 17).

The dotting instrument with wheel settings, which allowed the production of various types of lines, offered another possibility for furnishing the monochrome drawings with additional information. Richter's manufacturer's catalogue specified seven line types for identifying the most common construction materials: the dotted line, for example, referred to cast iron, the dash-dotted line to steel, and the elongated lines to wood.

As shown by the early plans of the engineer and architect Carl Séquin-Bronner, not only did technology influence the modes of graphic representation, but also vice versa, the representation technique influenced the development of new
tools. Already before the introduction of drawing instruments, Séquin-Bronner's detailed drawings—using various types of crosshatching and lines—attained a precision comparable to today's detailed plans created using computer-aided-design (CAD).

The simplification and optimization of drawing processes, as well as constraints imposed by reproduction processes, led to new discoveries in graphics; for example, beginning in the 1870s, two different line thicknesses were used to generate a three-dimensional effect. While dividers, rulers, and protractors sufficed for the representation of architectural drawings in the eighteenth century, a highly specialized tool industry emerged for draftsmen in the nineteenth century, bringing hundreds of drawing instruments onto the market. Surveyors, mechanical engineers, and ship builders developed plan standards even earlier than architects, and they also created norms and symbol tables. Not surprisingly, the accelerated reproduction of architectural drawings in the technological world led to a loss of diversity in the means of representation, and with this, also a decline in artistic ambition, and a disappearance of the painterly allure that had been so characteristic of early drawings. The blueprint, in particular, and the industrialized and standardized building processes, in general, now became synonyms for progress.
Von der Strenge der Wissenschaft


(Suárez Miranda, Viage de Varios Pueblos, libro cuarto, cap. XIV, Lérida, 1658.)
Fig. 5: Working drawing for a pond in the garden of Schloss Bruchsal. First half of the eighteenth century.

Fig. 6: Ground plan, elevation, and section of the "model shed," 1771.

Fig. 7: Planning and surveying the project of the new St. Peter's Church on the cadastral plan by Bruchsal. First half of the eighteenth century.

Fig. 8: Palazzo del Piacere in Capranica. Measured sketch drawing in travel journal. Gaetano Goli, 1883.

Fig. 9: Kunsthalle Karlsruhe, ground plan of the upper floor with sheet for a sketch study glued on (area of the main staircase). Karl-Hubert, Heinrich, 1836/37.
Kennzeichnung der Baustoffe

(Farben in Schablonen)

- Erde in braun
- Lehm in grau
- Stein in gelb
- Stein in braun
- Holz in dunkelbraun
- Eisen in rot
- Stahl in blau
- Kupfer in grün
- Messing in rot
- Bronze in gelb
- Blei in grau

Fig. 10A: Sample plate for building plans at a scale of 1:100, from 1904.

Fig. 10B: Hand-colored lithograph for the standardization of colors and crosshatching in mechanical drawings.

Fig. 11: Crosshatching rules by Emil Oskar Richter, 1877.

Fig. 12: Dotting apparatus for different symbol lines, by Emil Oskar Richter, 1876. "For every type of line served a special wheel...its border furnished with the corresponding teeth or flings...which, on demand, should be inserted between the steel plate or feather and the brass plate or the frame."

Fig. 13: Pantograph with free swinging arms by Jakob Goldschmidt, Mechanicus in Zürich, 1864.
For very precise measurements of smaller areas: mechanical integrator by Jakob Ammler-Laflein in Schaffhausen.

Exposure frame for blueprints.

Early application of standardized cross-hatching on blueprint, new factory building, Schaffhausen. Karl Moser, 1905.

Changing representations as a result of new drawing instruments and enhanced reproducibility through blueprints, buildings were no longer highlighted with colors, but instead, with cross-hatching. In addition, the planes used to build was marked with hard shadows and different line widths. Areas with different levels of brightness could be generated by changing the intervals of the crosshatching machine. Different symbol lines - often generated with dotting instruments - differentiated the lines according to their function.

Schulhaus Hirscheggstrasse, Zurich, civil engineer: Bureau: signed C. Schüttelnberg, 22 March 1890.

Graphic innovation through new working processes and drawing instruments: the draftsmen used two different feather widths for tracing the pencil drawing with ink. The contours of all parts to be highlighted are accentuated with a broader line on their right and lower sides, thus creating a shadow; this enhances spatial legibility. The technique became widespread around the 1870s. New factory building Pasquale-Burgh in Vienna, built by C. Sequeja, Bronner, 1902.
The implementation plans for the Sustenstrasse, completed in 1946, were created directly before and during the caesura of World War II, which shaped modern Switzerland. With their help, we can well understand aspects that were fundamental at the time to the construction of this important new road. Along with their actual function as instructions for building, their study also makes further levels of meaning accessible. For example, they provide evidence of an attitude toward building in the Alpine area that was typical at the time and document a culture of drawing that has largely been lost today.

Engineering landscapes

"In the 11th section, the road surmounts the valley step of Feldmoos in a loop that extends far to the north through the Gschletterschlag forest. The hairpin bend is reached via several tunnels... half-galleries, over small bridges and sloping viaducts. It is located in an abrupt, sloping recess in the Wendenlamm. For a short stretch, the high forest opens to reveal a view; upward to the 3,000-meter high ridges of the Wendenstocke and beyond over Gadmen valley to the distant Wetterhorn. Filling in the hollow encircled by the street will lead to the creation of a beautiful parking spot."

This introductory overview by the project author E. Nil is testimony to a remarkable sensibility for the road's scenic potential. In a pioneering monograph on the Sustenstrasse, Werner Zschokke describes the mentioned hairpin bend, which moves around a jag of rock that has been left in place, as the highpoint of a first, romantic section of the road. He makes the conjecture that "...with his road, the planner wanted to get around this point."

The report on the project in general from 1935 shows that in this partial section, the layout of the road of the preceding project was entirely reworked to lessen the "great number of hairpin bends," which must "presently be identified as a transportation hindrance." The staging of the mountain landscape for tourists—an outstanding quality of Sustenstrasse from a contemporary perspective—was, however, not mentioned as a distinct criterion in its design. It seems to have arisen almost incidentally, as a side effect of technical and operational considerations: a route planning that is transportation-friendly with low grades and few turns avoids the danger zone of avalanches descending from the Wendenstocke and uses the existing shape of the landscape allowing the road to be built with the least possible outlay in terms of material and transport.

However, the mentioned report also illustrates that the planners were thoroughly aware of the demands of the tourist gaze. The investment in road building was legitimized with a bundle of arguments related to transportation, the military, construction, and tourism. There is "...no doubt that a modern motorway over the Sustenpass, which is so blessed with natural beauty, would be an appropriate draw for motorists from other countries." On the other hand, the Sustenstrasse is important not only as a "tourist road," "...but just as much or even more so, as a military road." In the case of an attack coming from Italy, the Furka could be made impassable by means of artillery fire. The Susten, as a topographically protected connection between Gotthardachse and upper Aaretal thus presents "...an extremely important link for our national defense." This convergence of arguments from the military and tourism is characteristic of the political legitimation of investments made in the Swiss Alps before, during, and after World War II. The planning of Sustenstrasse came at a time when the road was to be built with the least possible outlay in terms of material and transport.
In this way, the outlay in terms of work, energy, and material can be kept within limits, thereby saving building costs. However, at the same time, the carefully aligned mass balance points to a creative understanding of the relationship between road and topography. The building of the road is understood as a complex regrouping of material found on-site rather than as an insertion of an independent structure into the site. The demand that “…the artificial installation of the road construction” should “…blend as naturally as possible into the terrain,” is found in a prominent position in the “norms for mountain roads” of the VSS, declared as binding in the context of the federal decree from 1936.9 There, profile types favorable for this purpose were proposed, which were applied and further developed in the Sustenstrasse (fig. 2). Also fitting with this logic is the concept of short tunnels through arêtes, a solution that is also used in places where an incision would probably have been simpler in terms of realization. Jürg Conzett mentions these tunnels as an example of “…conscious decisions about shaping the landscape: it was thought best to leave the ribs of the terrain intact.”10

A culture of drawing

In addition to the plans’ content that was explicitly depicted in graphics or clarified in writing, from today’s perspective, also the “style,” that is, the way the plans are drawn, is remarkable. First, the depth of their graphic depiction is impressive. For example, examining the situation plan from a distance mediates a concise overview of the entire section. Beholding the drawings from up close reveals an astounding wealth of information about details and cross references. From today’s perspective, also notable is that the plans contain hardly any irrelevant information. The elaborate manual labor seems to have led to a consistent reduction to essentials. Finally, surprising is how a movement through the landscape is successfully sketched out. Together with the spectacular longitudinal profile (fig. 3), the ground plan develops a choreographic quality, which seems to express a particular attitude with regard to the Alpine landscape.

The graphic depiction is oriented on cartographic conventions, for example, in the way the typography and orientation of writing are handled. Information that refers to the road itself is set parallel or at a right angle to the course of the road, while the field names, height notations, and titles follow the orientation of the sheet. Also the intelligent folding principle, which enables leafing through on the construction site, is reminiscent of a map. The intersection points of the hundred-meter network of the national topographic survey run across the entire sheet in a fine grid. However, noticeable in contrast to today’s implementation plans, which are furnished with photos of the terrain, is the lack of structural contour lines.

What might shed light on the categorization of this drawing culture is a sidelong glance at another...
major project that was likewise taken up before World War II: the mapping of the Alpine area at a scale of 1:25,000. Eduard Imhof, professor of cartography at the ETH Zurich beginning in 1925, propagated for years, a nationwide, uniform cartography that would represent the mountain area, hitherto depicted at a scale of 1:50,000 (fig. 4), in the same degree of detail as the flat land. "With the assistance of all civil national organizations interested in the map,"—namely, the Swiss Alpine Club—Imhof, himself a passionate alpinist, was ultimately successful.12

One could identify the effort at a precise, minimal, and at the same time beautiful graphic representation of complex reality as the most important parallel between the drawing style of the implementation plans discussed here and the official maps of the federal cartography. In the 1950 compendium Gelände und Karte published by the Federal Military Department, Imhof demanded that "art and science" strive together for a true-to-form, graphically legible depiction.13 Imhof pointed out that good maps do not arise simply as the automatic result of consistent and composed.

Cartographic images such as these permit interpretation—beyond the drawing style of the implementation plans discussed here and the official maps of the federal cartography. In the 1950 compendium Gelände und Karte published by the Federal Military Department, Imhof demanded that "art and science" strive together for a true-to-form, graphically legible depiction.13 Imhof pointed out that good maps do not arise simply as the automatic result of consistently applied representation processes, but instead—like pictures—have to be carefully designed and composed.

For the overview maps of the Sustenstrasse, a compilation of the sheets 392 Mägglingen (1932) and 393 Wallisellen (1933) from the Sagittal maps were printed, in which the forests and meadows were set in color in the area affected by the road. In 1948 the sheet 255 Sustenpass from the federal cartography was published for the first time at a scale of 1:50,000. The corresponding sheets at a scale of 1:25,000 followed in 1967 (sheet 255 Maennwil) and 1969 (sheet 120 Innerserkirchen).


14 Cametti, Elias, Crowds and Power, New York: Forster, Strauss and Giroux, 1984, p. 175. "The Swiss plans for defence during the last two wars expressed this equation of the nation and the chain of the Alps in a curious way: in the case of an attack all the fertile land, all the cities, and all the centres of production were to be left undefended. The army was to retire to the mountains and would only have fought there. People and country would appear to have been sacrificed, but Switzerland would still have been represented by the army in the mountains, the crowd symbol of the nation would have become the country itself."
When Saarinen's Trans World Airlines Terminal was preserved as a landmark in 1994, the landmarks preservation based it on a myth. They justified the protection order by claiming that Saarinen had attuned the structure to the then new jet planes and thus revolutionized airport architecture not only in terms of design, but also operations. The preservation order thus reinforced a fundamental misunderstanding: In order to avert the threat of demolition, they bestowed the terminal, which no longer met TWA’s operational demands, with a seductive aura. They drafted an idealized image of the real structure and monumentalized it. As monument, the building ritualized the ability to ignore its grave deficits in terms of operational technology. The working drawings for the terminal were also part of this mythmaking. While at the time of its construction they were still a purposeful tool and instrument for communication among architect, engineer, and construction firm, they now serve to glorify the terminal and Saarinen.

Supposedly jet-ready

This development reaches back to the airport terminal’s origins beginning in late 1955. In the battle for customers in the fiercely contested U.S.-American market, the airlines stepped up their efforts to differentiate themselves from one another via their airport terminals. The peak of this development came with Idlewild Airport in New York (today: John F. Kennedy International Airport), where the major American airlines could build their own terminals, and intensely market themselves. TWA was heavily supported in this endeavor by Aline Saarinen, the architect’s wife and public-relations manager. However, she used the terminal to pursue also her own goals and guarantee Saarinen the place in architectural history that he aspired to. “Now I observe myself ardently promulgating the Eero-myth,” she confessed in 1958. Together with the client, she coordinated communication measures along “four target moments for publicity”: the awarding of the contract, presentation of the implementation design, during headway in construction, and finally, on the occasion of the opening on May 28, 1962. One of the main goals in this was to present Saarinen's terminal as state-of-the-art in terms of operational technology and capable of handling jet planes. Despite increasing passenger numbers, TWA had frequently been operating in the red from the time of its founding in 1930 and therefore occasionally demanded increased efficiency and cost effectiveness from the ground infrastructure.

The design by Eero Saarinen & Associates (ES&A) clearly bore witness to this. It corresponded with the concept of increasing the number of automated and mechanized processes, and thereby followed the principles of operations research. Starting from extensive time studies at numerous airports and flow charts of ideal handling processes, ES&A designed a succession of nearly threshold- and door-free spaces, a marked difference from the hitherto predominant chamber-like spatial concept of airport terminals. Additionally, with the smoothly functioning machine as operational model, diverse handling stations were mechanized and automated in order to check-in the passenger through a structure that was precisely optimized, and therefore highly specialized for the building’s purpose. However, important insight relevant for the ground check-in of the jets that had been introduced during the terminal’s planning stages was first available when the structure was already mainly finished. In addition to that, the financially strapped TWA was forced to...
make savings in early 1961, which further decreased serviceability. Thus, when the Trans World Flight Center opened it was neither on par with the latest findings nor specifically tailored to the new generation of aircraft. Beginning in 1970, at the latest, when the first wide-bodied jets had to be checked-in, the departure hall proved inefficient and inept at handling the ever more numerous passengers.

Both the client and Aline Saarinen knew of the long walk, the detrimental height offset between drive-up and airplane entry, inconsistent weather protection, and capacity shortages, yet they nonetheless emphatically marketed the terminal as jet-ready. And there is more: their communication systematically reacted to the deficits by glossing them over. For example, shortly before the start of construction, the client emphasized in a communication that her new airport terminal would not only be capable of handling the new generation of jumbo jets, but also future generations of supersonic aircraft. The aviation operation also willingly supported the claims of operational progress with detailed descriptions of the elaborate architecture of the arches. Combined with fabricated photos and descriptions of strictly organized, smooth construction processes, as well as the many ingenious and operational claims, this was seemingly commensurate with the promised efficient, jet-ready, check-in process. The media as well as construction firms and suppliers cultivated the image of an operationally high-standing airport terminal.

The misconceptions were transcribed, became established, and turned into supposed facts. Until the present day, reviews present the misunderstanding that Saarinen revolutionized airport architecture with the TWA Terminal.

Elaborately produced building plans

The extraordinarily complex production of the building plans for the terminals also would have fitted neatly into the public relations campaign. On April 10, 1958, Helmut Borcherd, a German architect at ES&A, commented, "The plans for the TWA building are now finished, the countless models have now been put in storage, the large model, that you can crawl into, is covered over."

With this statement, Borcherd drew along with a sigh of relief, a closing line under the intensive, more than two-year design work on the terminal. The "arduous process," as the architect would later remember it, was initially entirely under the auspices of the search for the desired building form, then a way to formulate this in a plan. The architects created between three-hundred and five-hundred models before Saarinen was finally satisfied with the design. "Then," the architect summarized, "...we were able to make drawings of what we actually had."

As Borcherd explained, in the production drawing division at ES&A the models were "scanned and drawn" by the architects responsible for completion.

The complexly organized forms were illustrated there by connecting points of the same elevation, that is, by means of contour lines, as used in map illustrations. The translation of the models into working drawings was nonetheless extremely complex: the architects made countless horizontal cuts through the imaginary building from the four arched supports, at an initial distance of two feet (61 centimeters). The numerous curves of the interior were defined in the ground plan by radiuses and their center point registered in a coordinate system. There were ninety-two of these set points, which were listed in a book. The architects were not able to fall back on experience in their work, but instead, had to experiment. They thus determined that the slightest deviations in the blueprints, for example, as a result of heat expansion, would result in major imprecisions in the shell plans. In order to avoid this, they introduced an identical grid in all plans and doubled the number of elevation lines. ES&A prepared roughly 130 plans in about 5,500 hours of work.

But the design was still not ready to be built. Architectural designs are only the basis for the engineering plans and the building company's production plans. Over a period of nearly two years, the architects, engineers, and later the construction firm compared their plans. For the latter, the concrete shell, which additionally required even more precisely detailed plans, presented a major challenge. In part with computer support, a novelty in the construction industry at the time, they were ultimately successful in accurately defining every rib and connection between buttress and arch. But the building plans were not finished even now, as Chuck Parise, architect at ES&A, recalls, shortly before breaking ground the financially strapped TWA announced that it had to make cutbacks. Bent over sepias drawings, the client, architect, and construction firm made two and a half million dollars in savings with a few thick pencil strokes; the following day, building began.

Additional marketing tool

Just as elaborate and innovative the production of the final plans was, Aline Saarinen and TWA did not use them to market the terminals and its architect. This is surprising. Similar to the meticulous construction planning, the precise realization, ingenious special accomplishments, and much more, the preparation of the plans would have offered useful public relations material to fortify technical progressiveness and operational efficiency. In light of the breadth of the marketing themes, advertising means, and channels of communication, this was not a simple oversight. In addition, remarkable is that specially prepared presentation plans were used in publications rather than implementation designs. The representation of structures on paper is simply a means for understanding," declared Borcherd in 1960. From this, it can be concluded that at the time, other than the signage, ES&A received no reliable information from the client about the check-in of the new generation of airplanes. See ES&A, "Plume position plan," implementation design, ES&A Saarinen Collection (MS 593), Manuscripts and Archives, Yale University Library, series IV, box 274.

See TWA, "Amendment of agreements covering construction of Uni Terminal at New York International Airport to provide increased facilities" [meeting protocol of the ad hoc committee] Nov. 1960, p. 1, Floyd D. Hall Papers (RG 482), Au­denheim University Special Collections and Archives, series I, box 2, folder "Meetings, Agendas & Reports, November 1960."
building plans served simply for communication between architect, engineer, and construction firm, and did not yet perceive a marketing mission. But this would change. An early indication of this is the monograph Eero Saarinen on His Work, which his widow published in 1962 shortly after the architect's premature death, to guarantee "one of the twentieth-century's foremost architects" the place in architectural history that he aspired to. In addition to Saarinen quotes, the exhibition of works was based on large-format pictures, including a working drawing for the TWA Terminal; the other projects, on the contrary, were documented exclusively by presentation plans. They thereby set the hoped-for "keystone for all subsequent works," as it says in the cover text. The later monographs and articles published beginning in 2003 document the departure hall with, in part, full-page building plans. Presentation plans, whether originals or newly created ones, which show the spatial connections so important for an airport terminal more clearly than production plans, are presented only in small versions, or are missing entirely.

The fact that the flight center was usually the only project in the monographs illustrated based on production plans has to do with their enormous visual effect. The numerous bends and lines are capable of expressing the building's exceptional geometry especially clearly. The fact that the building plans were shown due to their aesthetic value, however, is also shown in that their elaboration was only mentioned in passing, if at all. Even more important, however, is that the original, handmade plans point to the original state of the departure hall, which differs so blatantly from today's version. Saarinen's landmark-preserved terminal was closed in 2001 due to its operational insufficiencies and has been empty since, awaiting its next use, wedged between newer, much larger airport structures and a sky train. The working drawings disregard this context. Like the well-known, often published photos by Ezra Stoller from the opening year, the many vintage memorabilia in internet auctions, and the latest computer generated imagery, they remove the flight center from the temporal process of decay; lend it a seductive, nostalgic aura; and negate the operational and commercial demands currently made of the ground infrastructure. Whereas the plans once enabled understanding among architect, engineer, and construction firm, they currently serve instead for Aline Saarinen's intended glorification of Saarinen and his terminal.

The changed communication function is exemplary of the transfigured image of the TWA Terminal, whose reproduction value is now the building's only use. As its ability to perform diminished, the value of the airport building was defined more by its media presence than its operational capabilities. The unique exterior of Saarinen's building consequently advanced to the epitome of the modern airport terminal, even becoming a monument for airline industry buildings par excellence. The TWA Flight Center is the embodiment of an architecture that is an event in and of itself rather than serving as an environment for a particular operational event, such as check-in.
THE AXONOMETRIC PLAN

On the objectivity of the architectural drawing

The path from the first sketch to the working drawing traces out a part of the trajectory from idea to building. The process is one of increasing objectification, intensification, and materialization. The technique used for visualization in initial sketches, ranging from fine pencil drawings through to charcoal drawings rich with contrasts, reveals a great deal about the architect. The working drawing, on the contrary, should be free of this subjectivity that is found in the architectural drawing, and instead, direct attention to the architectural object. Rather than expression of the gestural qualities of the sketch, the working drawing offers a high degree of specificity: it does not require interpretation, but instead, materialization. It exists as a graphic projection at the border between idea and realization.

The working drawing must contain all of the necessary information for the realization of a structure. The state of building technology around the mid-nineteenth century and the organization of the construction site made it possible to understand the working drawing along these lines. At the same time, the Positivism of the era led to the conviction that the correct technical or scientific visualization of an object had to exclude all "subjective" factors. The working drawing, resulting from industrialization of the building site, became increasingly more specific and precise. The model for this was provided by the mechanical mode of operation of the machine, its logic, and the absolute objectivity of the image it produced. The designer's presence was no longer required at the construction site, designs traveled; major international offices produced drawings that set the standard in terms of their great detail and precision.

The issue of the architectural drawing's objectivity gained particular relevance as architects of the modern movement abandoned perspective-based architectural representations in favor of isometric drawings. In mechanical engineering, in particular, axonometric projection was considered an efficient method to visualize spatial relations true to size. Axonometric projection, as parallel projection not tied to the position of an observer in space, was considered an objective means of technical drawing in contrast to perspective.

The advantages of simple measurability and transferability of dimensions is not sufficient to explain the popularity of axonometry in twentieth-century architecture. Daniel Libeskind and the architects who belonged to the group known as the New York Five, such as Peter Eisenman, produced axonometric projections for their works. The "official" entrance of axonometric projection into architectural representation occurred at the first exhibition of the Weimar Bauhaus in 1923. In one blow, isometric projection superseded perspective, which had attained a high degree of virtuosity during the early centuries. A large-format perspective, often prepared by a professional "renderer," was the piece de résistance of every competition project. The question of why architects returned to a seemingly more "primitive" mode of representation in the modern era is therefore more than warranted.

The isometric drawing that Herbert Bayer made in 1923 for Walter Gropius's director's office at Weimar's Bauhaus does not show the space from the view of an observer, but emphasizes instead the three axes of the orthogonal coordinate system as the spatial orientation that defines the form of the room and its furnishings through to the...
fluorescent tubes spanned through thin cables (Fig. 2). The drawing is meant to reveal the conceptual stringency and logical consistency of the solution, rather than showing the result as the visual perception of an observer. Such axonometric projections should appear as products of the form-finding process and not as retrospectively drawn representations of a project worked out in full detail.

It is often claimed that in Bauhaus the use of the so-called cavalier perspective—a parallel projection that does not distort the elevation plane—corresponds with the principles of De-Stijl aesthetics. But Fred Forbät, employed in Walter Gropius’s office at the time, claimed in his memoirs that he was the one to first use the cavalier perspective in Bauhaus. The drawing points to the military origins of this form of representation; used for visualizing the design of fortresses.

At the technical universities in Europe, engineers rather than architects used axonometric drawing. Christian Rieger demonstrated in his work Perspectiva militaris (1756) that the drawing of ground plans, elevations, and perspectives are not necessary for understanding the edifice, because the “military perspective” unites all necessary information in one drawing. This was the base for the renowned book Géométrie descriptive by Gaspard Monge (1799). Monge was concerned with the planning of military complexes that offered the enemy the least possible surface area for attack, but from which the defenders could fire from an optimal angle. The term “projection” shows the direct connection or analogy between the beam of projection and the trajectories of the projectiles.

The practical advantages and practical aesthetics of the axonometric projection emphasized by Forbät were inseparable from one another. Axonometric drawings were admired for their precision; the folio publications by Auguste Choisy on the history of building constructions have a special significance in this regard. Choisy was able to mediate the structural clarity of major spatial constructions in a suitable manner of representation (Fig. 4). The axonometric (and perspectival) drawings by Atelier Bow-Wow, which the architects of this Japanese studio call “graphic anatomy,” play a similar “panoptic” role—all necessary information for realization is contained in a single drawing (Fig. 5).

In Renaissance perspectives, the vanishing point corresponded with eternity, which in Erwin Panofsky’s much discussed text Die Perspektive als “symbolische Form” (1927) was interpreted theologically and set in a charged relationship with the commandment against the portrayal of God. Axonometric projection found an alternative for this matter—the interminable was not represented by a point, the projection occurred with parallel beams. The image still had depth, but the eye of the observer was not bound to a set point. The removal of the vanishing point enabled games with picture puzzle tilts and blurring of the border between surface and space.

Russian Suprematism, in addition to mechanical drawings and De-Stijl aesthetics, paved the way for the metamorphosis of the vanishing point; its transformation to an inner core of the spatial object. Particularly important in this regard was El Lissitzky’s contribution “K. und Pangometrie” in the Europa-Almanach (1925), in which Lissitzky attacked the myth of naturalism and the supposed objectivity of perspective.

The American architectural draftsman and occult thinker Claude Bragdon took aerial projection as starting point for his contemplations on axonometric projection in his essay collection The Frozen Fountain published in 1932. The hero of the book, Sindbad, took a journey in the world of geometric forms and on his journey in search of the ideal manner of visual representation, explained: ‘Now an isometric perspective is [...] like an airplane view in that the vanishing-point is far removed—is at infinity, in point of fact—and consequently such a perspective, though itself a distorted image, is free from that order of diminishment and distortion to which ordinary perspective is subject, for that aims to reproduce the optical image in which the size of objects diminishes in proportion to their distance away, and parallel lines converge, which, though true to appearance, is contrary to fact. Isometric perspective, on the other hand, less faithful to appearance, is more faithful to fact; it shows things more nearly as they are known to the mind: Parallel lines are really parallel; there is no far and no near, the size of everything remains constant because all things are represented as being the same distance away and the eye of the spectator everywhere at once. When we imagine a thing, or strive to visualize it in the mind or memory, we do it in this way, without the distortions of ordinary perspective. Isometric perspective is therefore more intellectual, more archetypal, it more truly renders the mental image—the thing seen by the mind’s eye.’

Bragdon’s conclusion comes as no surprise: “Sindbad finds that man is isometric.”

This conclusion may seem radical, but in principle, its essence was already long present in the practice and theory of architecture. Andrea Palladio presented his building drawings for entablatures and other details in sections and isometric drawings, easily legible for the craftsmen (Fig. 6). Leon Battista Alberti viewed perspective as one of the painter’s instruments that can lead to self-deception in the work of the architect. For that reason, he advised the draftsman to use “lineamenta,” an abstract line structure of ground plan, section, and elevation—supplemented by a model. Perspective was particularly suitable for representation of the existing world; Alberti described his theory of perspective in his treatise Delia pittura (1436). At issue was not the replacement of the representation of reality by an
abstraction, but instead, the "liberation" of the object defined by means of the perspective; not the opposition of humanism and anti-humanism, but rather, the critique of the single viewpoint. What axonometric projection does not generate is a frozen, ocular-centric view of reality.

A fundamental problem in the development of adequate projection systems was the discrepancy between increasing spatial complexity and the necessity that the building plan had to be legible for the craftsman. Palladio, like other Renaissance architects supplemented his sections with isometric views to show the elevations more clearly. The drawing, as instruction for the craftsman, required not only precision, but also a high degree of legibility. The complex vaulting systems of the late-Renaissance, and even more of the Baroque era turned out to be particular challenges. It was not possible to visualize the conical stone trompe by Philibert de l'Orme by means of the orthogonal system of ground plan, section, and elevation in such a way that the stonemason could determine the form of the individual stones of the arch. As a solution, he proposed a complex system of projection planes. The Baroque vaults by Francesco Borromini, Guarino Guarini, and Filippo Juvarra presented an even greater challenge for both the architects and the craftsmen. On the building site, the orthogonal system combined with axonometric projections remained a widespread means of communication[fig.7].

Between 1937 and 1961, Hungarian architect Béla Szövetszerkezet (textile construction), for which he prepared hundreds of hand-drawn sketches as basis for his experiments at a scale of 1:11[fig.8].

As we have seen, perspective and axonometric projection each construct different maps of reality. No map can correspond entirely with reality—each one pursues its own knowledge interests, its specific viewpoints. Although in the case of axonometric projection, the perspective of the observer, and of the maker of the drawing, is not captured in the image, this manner of visualization has its theoretical foundations in the dominant world-view. Axonometric projection is thus not at all "objective." The question of authorship of the building plan likewise poses a number of questions: the plan represents an interstitial realm between the architect whose name appears on the project, and the workers at the building site. This realm, with its complex social and professional connections, is rarely investigated, although the building plan is shaped by networks of factors who usually remain anonymous. Instead, traces of the master's handwriting are sought in the building plan. This search shows many nostalgic elements that no longer correspond with the practice of today's architectural production. In the essays by Adolf Loos, his interest in the participation of the craftsman who makes the object and in the maker's pleasure in his own work is obvious. Today, one hundred years later, examination of the social, cultural, and aesthetic processes that contribute to the production of the building plan remains a task to be resolved.
fig. 1
Peter Eisenman:
Diagram of House VI (1975), Cornwall, Connecticut.

fig. 2
Walter Gropius:
Isometric projection of director's room in Bauhaus Weimar (1923). (Drawing: Herbert Bayer)

fig. 3
Gerrit Rietveld:
Isometric projection of the ground floor Schroder House (1924), Utrecht.

fig. 4
Auguste Choisy:
Isometric depiction of an arch at the Palatine, Rome.
Atelier Bow-Wow: Section Nora House (2006), Sendai, Japan.

Andrea Palladio: Detail of the entablature Porta Maggiore (Drawing ca. 1550), Rome.

Charles F. A. Lory: Stereometric depiction of a trompe.


The author would like to thank Momoyo Kajino (Atelier Bow-Wow) and György Szondi-Kiss for permission to use the drawings.
The term "building plan" actually refers to two entirely different types of plans: on the one hand, plans for the construction of things, and on the other hand, plans of the construction of things. The first type describes an intention; the second, a reconstruction. The first adamantly defines how something should be built; the second, on the contrary, makes speculations about how something might possibly have been built. Building plans in the second sense—reconstructions—are more instruments for the arts and natural sciences; building plans in the sense of a constructional intention, however, belong within the realm of engineering. When, for example, in physics, talk gladly turns to the "world's building plan" in connection with the atomic structure of the world; or in biology, to "nature's building plan" in connection with the genetic code, the hypothetical character of these plans is ignored, and a higher—in past days one would have even said "divine"—intention is implied.

In the context of this publication, we are naturally more interested in plans for the construction of things: building plans in the sense of construction plans. These are, as a rule, not published—for that, we have publication plans. Building plans are addressed to professionals who have a well-trained, but narrowly focused gaze—craftsmen who build a house, contractors who calculate the price, and public agencies that authorize it. This circle of participants is initiated in the tricks necessary to generate the impression, the image, the ambiance that one envisions. I recall the pragmatic confusion of concrete and bricks in the framing of a building by Álvaro Siza, which I happened to pass by as a young architect, and the radiant clarity of the finished building, whose ambiance absolutely did not want to fit with the "bricolage" I recalled.

The architectural intention is thus not always directly recognizable in the building plan; sometimes, however, the plan reveals it indirectly by exposing the efforts to be taken behind plaster and paneling to create the desired space, the desired image.

These types of implementation plans are reserved for the insider circle of implementers. In recent years, however, a trend can be seen of illustrating buildings on the basis of their implementation plans. This might demonstrate, first of all, an insistence on the reality of construction as opposed to its ever more deceptive surrogate, the world of visualizations. Frequently, however, the published building plan serves as evidence that the spatially-effective and constructional structures are congruent, that is, that the moral imperative whereby form and structure are contingent upon one another has been fulfilled. For that reason, such architecture is usually presented by means of building plans that seek a monolithic expression, an elementary one rather than focusing on the tectonics of the multilayer wall. The recently published monograph of Buchner Bründler Architekten is a telling example of this.

Strictly speaking, every plan has two scales—the scale of the depiction and that of observation. Whereas the first has to do with the proximity of the depiction to that which it depicts—at a small scale, we see the building in the context of the city; at a large scale, we see, for example, the molding of the window sill—the scale of view has to do with the viewer's proximity to the depiction. Does she view the plan from a distance—whereby a distance can mean from afar, or simply with causal interest—or does she bend down close to make out a minor detail? Only as I gained more experience did it become clear to me that abstracted consideration is just as important as
XII

concentrated; the distant look as important as the close-up. The long underrated view from afar is informed by a graphic interest, by the interest of the visually-oriented person and not that of the architect. Building plans thus generate a sense of fascination in a way similar to musical scores, conciseness of something that cannot be reduced to a single glance; and where the stages of realization are still visible. I am able to obtain this perspective best with Japanese plans where no linguistic understanding whatsoever already draws me into the plan early on. From this perspective, plans become pictures, structures become diagrams. An actual oscillation begins between closer and more distant observation, from the overview to the detail, and back, which is helpful not only in examining the plans of others, but also in the composition of one's own. When this happens on the computer screen, a simple move of the mouse allows the switch between scales of observation, but strangely enough, this does not replace actually physically stepping back or squinting one's eyes in front of the large plan on the wall.

When plans are formulated with utmost clarity, they suggest that the depicted matter has been thought through to the end. They then mediate elegance in a mathematical sense: compelling logic, mutual determination of detail and whole, and the conciseness of something that cannot be reduced any further. Incidentally, the difference between earlier, manually drawn building plans and today's digitally produced ones is especially noticeable precisely in this regard. Whereas the pencil's thickness and the calm of the drafter's hand once limited the amount of information and forced a certain conciseness, the computer allows any scale desired. The drafter no longer has to abstract, hierarchize, or omit. The amount of information in today's implementation plans thus commonly corresponds with what was featured in earlier plans at the next larger scale. Of course, however, by amount of information, nothing is said of its density, which is why many digital building plans seem to be more loquacious than eloquent.

The building plan mediates a constructional proposition to those who are meant to realize the work that has been drawn. The closer the two, the one who plans and the one who realizes, the less has to be defined in plan form. In gothic masonry lodges, which we thank for what are probably the earliest building plans, the two actors were one and the same person—the master builder. Nowadays we cannot comprehend how architectural structures with the complexity of a gothic cathedral could be realized with so few plans, how instructions could be given to huge armies of builders, and how design continuities could be maintained in a building process spanning several generations. Although the small amount of handed-down gothic building plans is also due to the source situation—because realized plans were not preserved—they nonetheless illustrate the supposition of a shared knowledge of scale cultivated in the masonry lodges; a shared, deeper understanding.

Richard Serra once said of the music of Steve Reich, "Comprehension is a matter of complicity," which offers an apt description of this initiated community (if not identity) of designers and executors. In medieval building practice, however, not only were the persons of planner and executor one and the same, also "...in gothic architectural sketches, design ideas and geometric constructions were linked right from the outset." That would change in the Renaissance. The separation of design and production introduced in Alberti's and Filarete's architectural treatises meant that design could be freer, while at the same time, it now demanded additional explanation. Furthermore, the client was now also among those addressed by the plans, so that specific forms of depiction for presentation, calculation, and realization were developed. To make it possible to have someone realize the planned structure, they needed a basis that was true-to-size: the scale drawing was introduced, "disegno proporzionato," a scaled ground plan drawing grided according to a coordinate system.

Why take this brief look back? It is remarkable how, with the new means of the plan, new possibilities for mediation were opened, and also for even conceiving of space. Yet accompanying this gain for communication and conception, was a loss of the previously mentioned "complicity." This development began in the Renaissance, and ends in the somewhat paradoxical situation of today's architectural practice, in which we are increasingly freer in the design of form, while at the same time, ever more limited in the process of realization. On the one hand, digital tools enable us to conceive of nearly every form because we have available the instruments for its description, depiction, and fabrication. On the other hand, the planning must be increasingly more fault-tolerant and comprehensively defined as the planning route runs through ever more middlemen and has an increasingly longer lead time. Our professional practice is marked by extensive alienation between planning and realization. Full-service general contractor models force us to comprehensively define a project before we have even spoken with the tradesperson who will implement it; they therefore not only alienate us from the realization process in terms of content, but also in terms of time. Continuing standardization and juridification contribute their part to this development.

A good twenty years ago when Peter Zumthor identified building plans as musical scores, in which that which is not drawn is left to the liberty of the interpreter, he had to be certain of the "complicity" of the tradesperson. But what happens
when this interpretation degenerates into a mere vestige of what the planner had in mind?

The work by Studio Mumbai impressively shows how the organizational model of a gothic masonry lodge can be converted to the current form of a full-service general contractor mandate. As in the past, the planners are also the implementers, and thus the physical realization of these projects, which are characterized by a highly precise construction and accurate craftsmanship, can be carried out with models and a few free-hand drawings sketched out with a ballpoint pen on graph paper.

As the introduction to this volume explains, the working drawing is more capable than any other depiction of mediating the idea of a structure, and at the same time, its physical realization. Remarkable is the relationship of the two, idea and realization. After all, the building plan simply makes statements about the physical realization, whereas what it is actually about, that is, the idea of the structure "shows itself," as the philosopher and architect Ludwig Wittgenstein would have said.

In his Tractatus Logico-Philosophicus Wittgenstein developed a system of propositions stating everything that can be said about the world in words. This system, however, is merely a means as the actual goal is a different one. It is to show what cannot be grasped by words—the sublime, transcendent, the ethical and aesthetic (which Wittgenstein did not differentiate), and to do so within the contours of what can be said. "The method of 'calculating' the factual to show the valuable proceeds in a manner comparable with drawing a figure, and then acknowledging it as such, so as to perceive the space outside it as the space that excludes the figure."5

This effect can also be developed by a building plan in which everything that can be said is propagated in adamant precision so that the beauty of the imagined space is made vivid before our inner eye in extremely precise contours.

In reading a plan, the beauty of the imagined object is joined by the beauty of imagining, the beauty of the perception process. It is along these lines that I understand Frank Lloyd Wright's assertion: "There is more beauty in a fine ground plan than in almost any of its ultimate consequences."6
CHRONOLOGY

ALL PLANS ARE DEPICTED AT A SCALE OF 1:37

1925
KARL
MOSER
P1,p.130

1926
LUX
GUER
M2.p.249

1927
CA.
LE CORBUSIER,
ALFRED
ROTH
A71.p.25

1927
CA.
LE CORBUSIER,
ALFRED
ROTH
A72.p.27

1927
MOSER
ARNOLD
K7.P.705

1928
CA.
1920
MESSIER
K2.p.205

1930
FRANCESCO
BORROMINI
L3,p.229

1931
EARLY 19THC
HANS
STADLER
P5.p.129

1931
LE CORBUSIER,
JOHN
TORCAPEL
J2.p.187

1939
ALVARO
SIZA
05.p.87

1959
ALVARO
SIZA
05.p.81

1962
CA.
BRUNO HALLER,
FRITZ HALLER
HI.p.201

1962
SUGIER
MITSUTANI
CI.P.55

1969
LINA BO BARDI,
ANDRE-VAINER,
MARCELO FERRAZ
M2.p.251

1979
CA.
MAHENDRA
RAJ
DI2.P.101

1980
MAHENDRA
RAJ
DI2.P.101

1980
RAFAEL
MONEO
L3.P.227

1980
HERMANN
CZECH
L2.p.227

1984
FRANCESCO
BORROMINI
L3.p.229

1981
KARL
MOSER
P1,p.130

1984
CHRISTIAN
KEREZ
C5.p.117

1984
FABIO GRAMAZIO
MATTHIAS
KOHLE
83.p.37

1999
ELIZABETH DILLER,
RICARDO SCO FI DIO
E4.p.113

2001
ADAM CARUSO,
PETER ST.JOHN
CH.P.31

2004
GUILLERMO VAZQUEZ
CONJUECA
H5.p.173

2004
CHRISTIAN
KEREZ
C5.p.117

2006
FABIO GRAMAZIO
MATTHIAS KOHLER
B3.p.27
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314

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**L1-L10**

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L5, P. 233  ETH-Studio Monte Rosa, Department of Architecture, ETH Zurich; Prof. Andrea Deplazes, Bearth & Deplazes Architekten AG, Chur / Zurich, Daniel Ladner
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K1-K8

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INDEX

A
Aalto, Alvar L9, P.241
Acayaba, Marcos G2, P.151
Ammann, Gustav B4, P.39
Auer, Hans Wilhelm L1, P.243
Atelier S M3, P.253

B
Baum, Mirko C4, P.57
Baumann, Lorenz M4, P.255
Bayer, Herbert XI, fig. 2, P.304
Bill, Max B1, P.131
Bluntschli, Alfred Friedrich B2, P.35
Bo Bard, Lin M2, P.251
Bogdanovic, Bogdan A6, P.23
Borges, Jorge Luis VIII, fig. 2, P.290
Borromini, Francesco L3, P.229
Bouvier, Paul 01, P.99
Brechbühl, Otto K7, P.215
Breuer, Marcel D3, P.83;
Burle Marx, Roberto H2, P.167

C
Caminada, Gion A C2, P.53
Caruso, Adam C1, P.71
Cassetti und Rohrer Architekten D6, P.89
Choiu, Auguste XI, fig. 4, P.304
Conra, Charles L6, P.235
Cramer, Fred J7, P.195
Curjel, Robert G5, P.159;
Czech, Hermann L2, P.227

d
de Meuron, Pierre C8, P.65;
Demarmes, Hans E6, P.119
Deplazes, Andrea L5, P.233
Design To Production H1, P.165
Diderot, Denis VIII, fig. 1, P.290
Diller, Elizabeth E4, P.115
Ding, Jean-Pierre K1, P.203

E
Egger, Karl J4, P.189
Eicher, Fred B5, P.41
Eidenbenz, Eberhard E7, P.121
Eisenman, Peter XI, fig. 3, P.304
Ernst, Heinrich VIII, fig. 4, P.290

F
Ferraz, Marcelo M2, P.251
Frank, Heinz I, fig. 1, P.266
Frei, Barbara A3, P.17
Froelich, Adrian H4, P.171
Fug, Franz C5, P.59

G
Gantenbein, Stephan D9, P.95
Gisel, Ernst G4, P.155
Glauser, Otto D4, P.85
Gramazio, Fabio B3, P.37
Gropius, Walter XI, fig. 2, P.304
Gull, Gustav F3, P.135
Guyer, Lux M1, P.249

H
Haller, Bruno D1, P.79;
Haller, Fritz D1, P.79;
Hassler, Uta G3, P.133
Henry, Jacques C5, P.59
Her, Alan K4, P.209
Herzog, Jacques CB, P.65;
Hoffmann, Meke H7, P.177
Honegger, Villard de XII, fig. 1, P.308
Hu, Martin H4, P.171
Hubmann, Erich H3, P.169
Hübsch, Heinrich VIII, fig. 9, P.291

J
Jen, Bijoy A4, P.19
Jaray, Werner J7, P.195

K
Kerez, Christian E5, P.117
Kienast, Dieter M5, P.257
Knobel, Hilarius J8, P.197
Köepel, Hans-Dietman M5, P.257
Kohler, Matthias B3, P.37

L
Le Corbusier A7, P.25;
Leroy, Charles F. A XI, fig. 7, P.305
Leuinger, Hans C10, P.69
Leverentz, Sigurd C1, P.51
Lienhard, Ruedi D4, P.85

M
Meister Arnold K2, P.205
Mendes da Rocha, Paulo C3, P.55;
Mengoni, Giuseppe K8, P.217
Meyer, Hannes J6, P.193;
Mies van der Rohe, Ludwig G3, P.157
Mitsudan, Sigurd C3, P.55
Moneo, Rafael L7, P.237
Moser, Karl F1, P.131
Muller, Wilhelm J4, P.189
Murcutt, Glenn A2, P.15

N
Nervi, Pier Luigi E3, P.113
Nil, Eugen K6, P.213;
Nishizawa, Ryue H1, P.165

O
Olga, Halo G2, P.15;
Olgiati, Valerio F2, P.133

P
Palladino, Andrea XI, fig. 6, P.305
Pool Architects B6, P.43
Pouso, Severiano Mário Cover;
Prouvé, Jean C6, P.61

R
Raj Mahendra D2, P.101;
Recordon, Benjamin M6, P.259
Richter, Gerhard H7, P.177
Ridolfi, Mario D2, P.31;
Roeserens, Alan A4, P.231
Rietveld, Gerrit XI, fig. 3, P.304
Roth, Alfred A7, P.25;
Roth, Emil D3, P.83

320
# INDEX

## S

<table>
<thead>
<tr>
<th>Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saarinen, Eero</td>
<td>K5</td>
</tr>
<tr>
<td>Saarinen, Martin</td>
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## T

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## U

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## V

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## W

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## Z

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This publication is the result of several years of work by the Chair of Annette Spiro at the Department of Architecture at the ETH Zurich. At the very start stands the candidacy lecture by Annette Spiro. Stephan Rutishauser performed a great deal of the foundational work.

Our thanks go to all of the offices and archives who have made their plans available for this book. In addition, countless individuals have given us invaluable advice and supported us in our efforts. Without them, this collection would not have been possible. In particular, we would like to thank Marcelo Aflalo, Jakob Bill, Richard Böse, Miriam Dahinden, Carmen Diez Medina, Catherine Drouin-Prouvé, Catherine Dumont d’Ayot, Gerard Faber, Susanne Frank, Annette Freytag, Stephan Gantenbein, José Paulo Gouveia, Jürg Graser, Ariel Huber, Hansjörg Jauch, Erika Kienast, Marta Knieza, Bernd Kulawik, Bruno Maurer, Heinz Müller, Werner Oechslin, Martin Raspe, Ivan Ristic, Daniel Schlöpf, Anneliese Spiro, Marc Steinmann, and Jan Willmann.

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The book was created in close collaboration with Park Books and the graphic designer Esther Rieser. We would like to thank Esther Rieser and Thomas Kramer for their competent guidance and untiring commitment.

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What materializes on the plan is something that has arisen in the mind of the architect as merely a vague idea at first, and then become buildable through countless stages of refinement. The plan's contents should be realizable, tangible for client and tradesman. Beyond that, with the plan, a visibility ensues that endures long past the construction phase, until inhabitants and passersby are familiar with the building from every angle and in every light. Is it true then that the architect designs the stage on which life is played out? Today's plans are abstract instructions. There is no other way to overcome the technological variety. We were thus delighted, being involved with plans on a daily basis, by the examples in this book, which also give an account of the look-and-feel of the future structure.

Caretta Weidmann

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