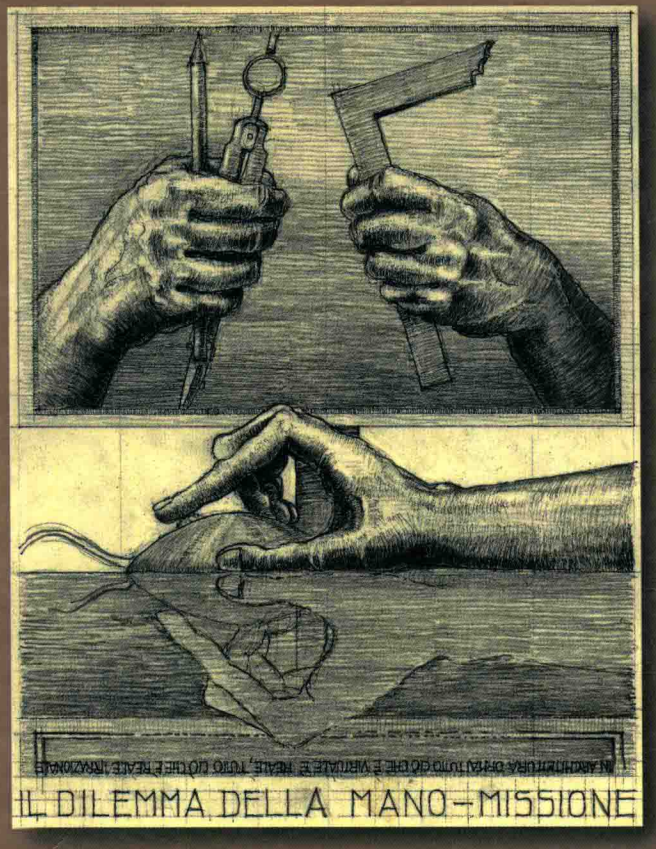
Construction and Design Manual
Architectural Drawings

Natascha Meuser

With additional contributions by
Augusto Romano Burelli, Peter Cheret, Hans-Dieter Nägelke,
Klaus Jan Philipp, Fabio Schillaci and Isolde Stamm



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Born in 1967, she holds a Dipl.-Ing. degree in architecture and is a member of the German architects' association BDA. From 1987 to 1991 Natascha studied interior design at the *Rosenheim University of Applied Sciences*. After taking her degree in 1991 she moved to Chicago to study architecture at the *Illinois Institute of Technology*, where she took a Master of Architecture in 1993. Alongside her academic studies she held placements and scholarships in Greece (set design) and Italy (painting). In 1993 she won the Art Institute of Chicago's *Harold Schiff Fellowship*. In 1994 she moved to Berlin where until 1996 she worked with Krier/Kohl Architekten and Thomas Baumann. From 2000 to 2005 Natascha taught classes on Building Law and Building Administration at the *Berlin University of Technology*. Natascha has been managing her own architecture projects since 1995.

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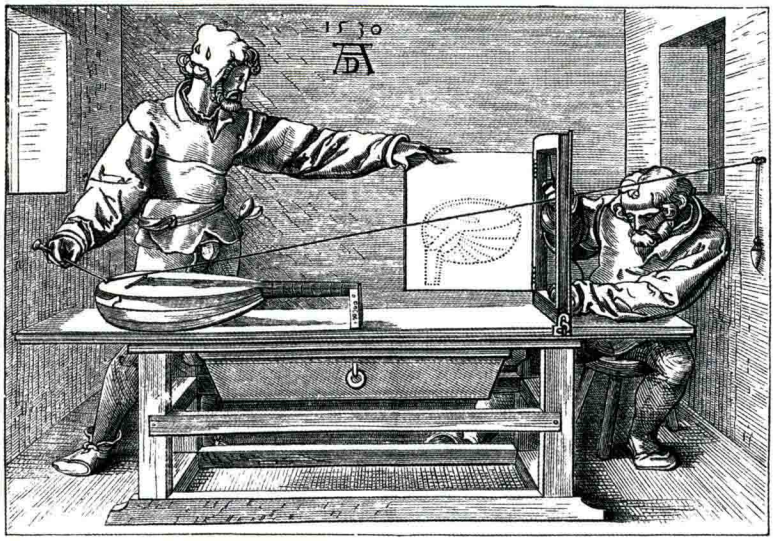

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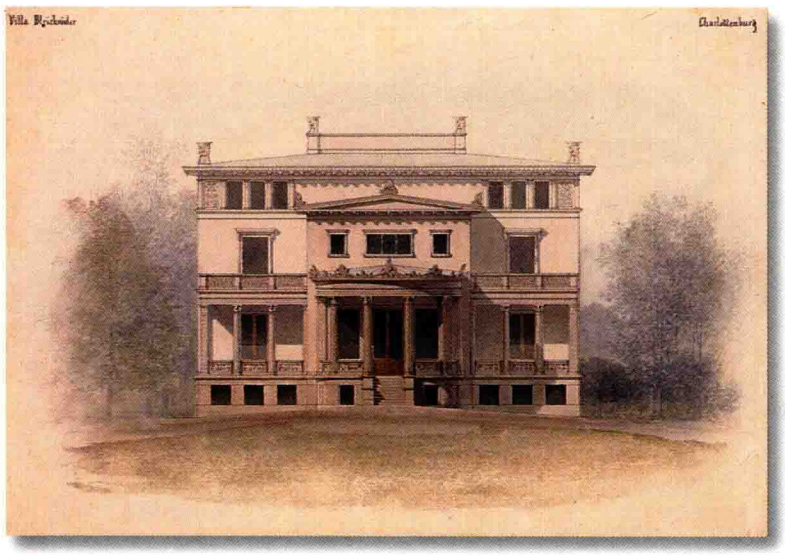

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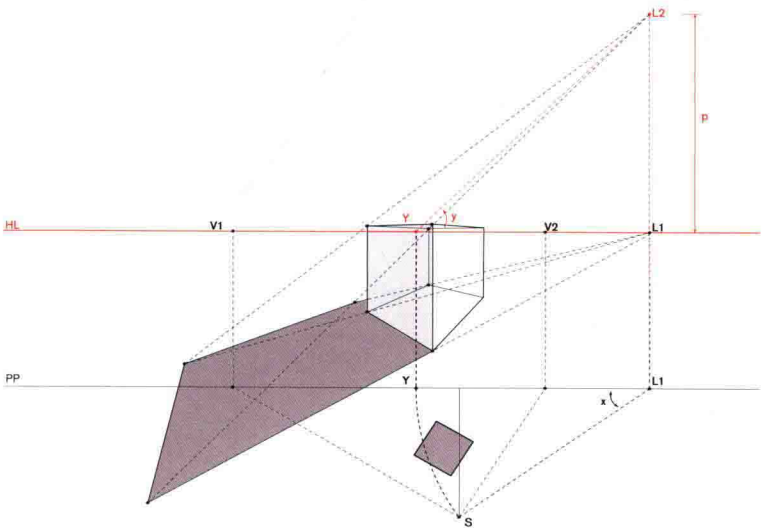

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Technical drawings

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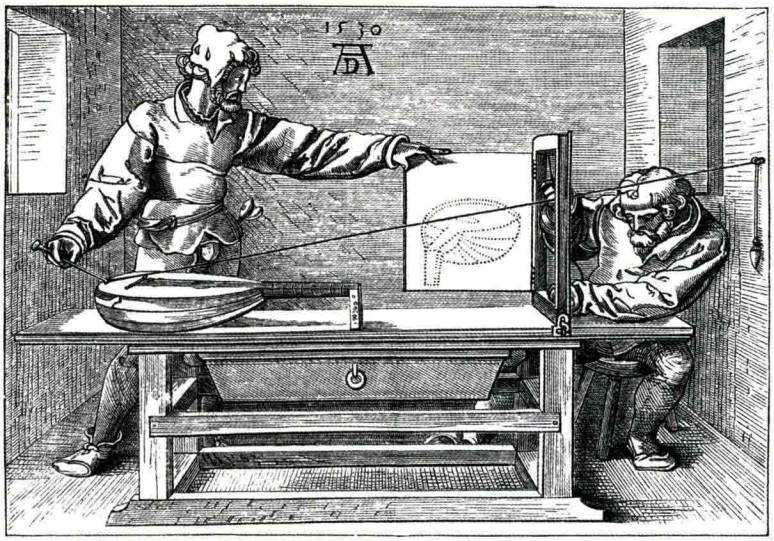

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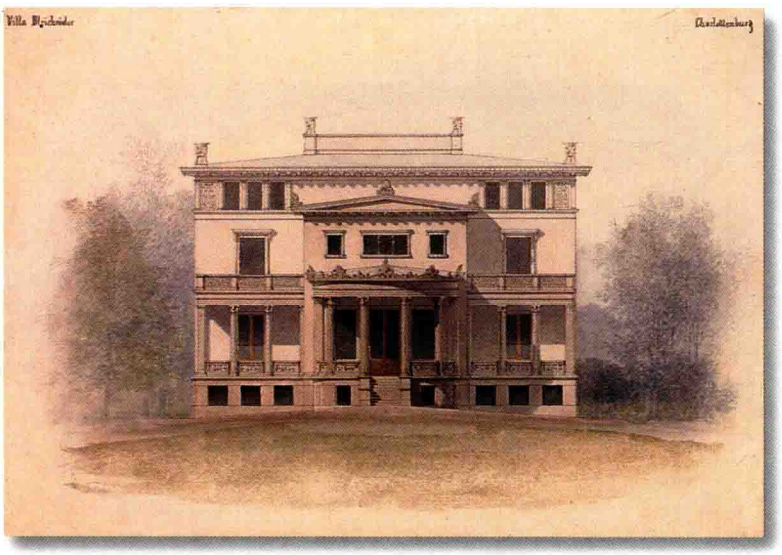

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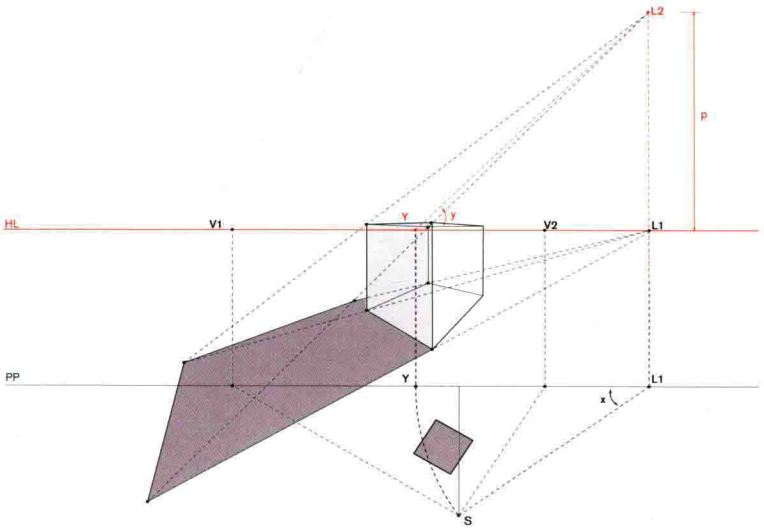

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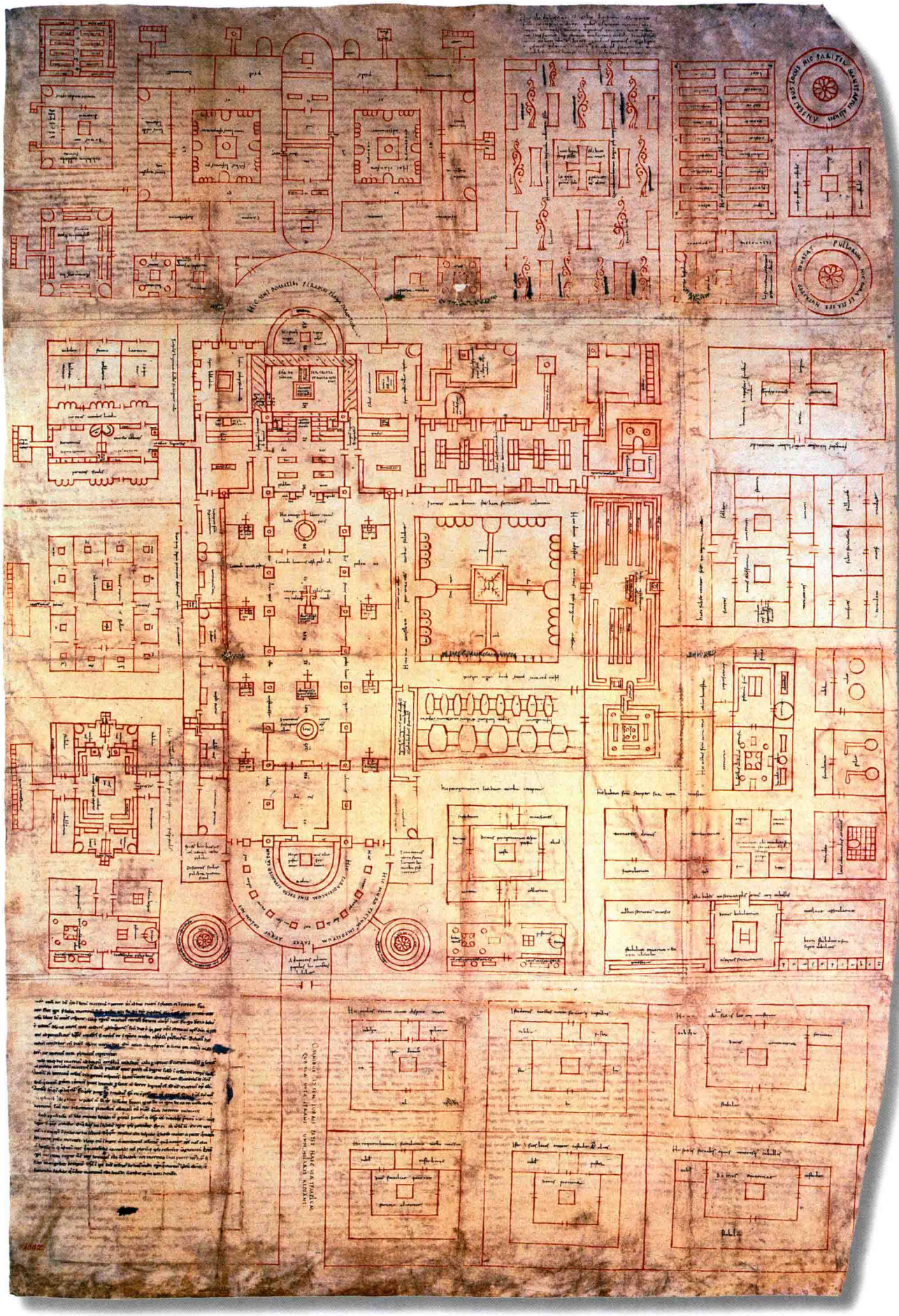


Klaus Jan Philipp
A brief history of architectural drawing

Outlining the complex history of architectural drawing in a few pages, and placing modern-day digital presentation techniques in their historical context, is a major, if not impossible, challenge. This attempt should therefore be seen as a prologue to a history as yet unwritten – surprisingly, since architectural historians since the Middle Ages have based their researches on architects' sketches, studies and other drawings. These are a rich source of information on how buildings were designed and what they looked like at a given time, and can help us to reconstruct those that no longer exist.

Architectural drawings have always attracted interest as what Josef Ponten calls 'unbuilt architecture'.[1] Apart from their documentary value, researchers over the past thirty years have focused on them as a form of artistic expression, with numerous detailed assessments of the drawings of the ancient Greeks and Romans,[2] the Middle Ages,[3] the Renaissance,[4] Baroque[5] and Classicism,[6] and the nineteenth and twentieth centuries.[7] Some are comprehensive assessments of individual collections,[8] many of which can now

1 Josef Ponten: *Architektur die nicht gebaut wurde*, Stuttgart 1925 (reprinted with an introduction by Frank Werner, Stuttgart 1987).

2 Joachim P. Heisel: *Antike Bauzeichnungen*, Darmstadt 1993.

3 Peter Pause: 'Gotische Architekturzeichnungen in Deutschland', dissertation, Bonn 1973; Roland Recht (ed.): *Les Bâtisseurs des Cathédrales Gothiques*, exhibition catalogue, Straflburg 1989; Wolfgang Scholler: 'Ritzzeichnungen. Ein Beitrag zur Geschichte der Architekturzeichnung im Mittelalter', in: *Architectura* 1989, pp. 36–61; Johann Josef Böker: *Architektur der Gotik*, Salzburg 2005.

4 Hans Vredeman de Vries and Hans van Schille : 'Piet Lombarde: New techniques for representing the object', in: Heiner Borggrefe and Vera Lüpkes (eds.): *Hans Vredeman de Vries und die Folgen*, Marburg 2005, pp. 101–8; Josef Ploder: *Heinrich von Geymüller und die Architekturzeichnung*, Vienna 1998; Werner Oechslin: 'Geometrie und Linie: die Vitruvianische "Wissenschaft" von der Architekturzeichnung', in: *Daidalos*, 1, 1981, pp. 20–35; Werner Oechslin: 'Architektur, Perspektive und die hilfreiche Geste der Geometrie', in: *Daidalos*, 11, 1984, pp. 39–54.

5 Carl Linfert: 'Die Grundlagen der Architekturzeichnung', in: Kunstwissenschaftliche Forschungen, 1, 1931, pp. 133–246; Elisabeth Kieven: Von Bernini bis Piranesi. Römische Architekturzeichnungen des Barock, Stuttgart 1993; Adolf Reinle: *Italienische und deutsche Architekturzeichnungen, 16. und 17. Jahrhundert*, Basel 1994.

6 Werner Oechslin: 'Emouvoir: Boullée und Le Corbusier', in: *Daidalos*, 30, 1988, pp. 42–55; Winfried Nerdinger, Klaus Jan Philipp, Hans-Peter Schwarz (eds.): *Revolutionsarchitektur. Ein Aspekt der europäischen Architektur um 1800*, Munich 1990.

7 *Visionen und Utopien. Architekturzeichnungen aus dem Museum of Modern Art*, exhibition catalogue, Frankfurt, Kunsthalle Schirn, Munich 2003; Horst Bredekamp: Die Architekturzeichnung als Gegenbild, in: Margit Kern, Thomas Kirchner und Hubertus Kohle (eds.): *Geschichte und Ästhetik. Festschrift für Werner Busch zum 60. Geburtstag*, Munich 2004, p. 548–553; Jürgen Paul: 'Der Architekturentwurf im 20. Jahrhundert als kunsthistorisches Arbeitsfeld', in: Stephan Kummer (ed.): *Studien zur Künstlerzeichnung. Klaus Schwager zum 65. Geburtstag*, Stuttgart 1990, pp. 308–321; Carsten Ruhl: 'Im Kopf des Architekten: Aldo Rossis La città analoga', in: *Zeitschrift für Kunstgeschichte*, 69, 2006, pp. 67–98.

8 Ekhart Berckenhagen: *Architekturzeichnungen 1479–1979 von 400 europäischen Architekten aus dem Bestand der Kunstbibliothek Berlin*, exhibition catalogue, Berlin 1979; Winfried Nerdinger: *Die Architekturzeichnung. Vom barocken Idealplan zur Axonometrie. Zeichnungen aus der Architektursammlung der Technischen Universität München*, Munich 1985; Werner Broda (ed.): *Dreiecks-Verhältnisse. Architektur- und Ingenieurzeichnungen aus vier Jahrhunderten*, Nürnberg 1996; Jürgen Döring (ed.): *100 Ideen aus 200 Jahren. Architekturzeichnungen des Barock, Klassizismus und Historismus*, Hamburg 2003.

Plan of a monastery, St. Gallen, c. 820
Parchment, 77.5 × 112.0 cm
Source: bpk/Hermann Buresch

be viewed online.[9] Other studies have considered the drawings of individual architects as oeuvres in their own right.[10] But overviews of this subject – which do not concentrate on specific collections – are few and far between: one example is Helen Powell and David Leatherborrow's 1982 book *Masterpieces of Architectural Drawing*.[11]

There have been many definitions of what constitutes an architectural drawing. It is an umbrella term covering works as varied as sketches, finished artwork, presentation and working drawings, copies, tracings, reproductions, travel sketches, academy drawings, and illustrations.

Of these, the most important to historians of art and architecture are sketches, which record the architect's first tentative ideas, and presentation drawings, the means by which they communicate with their clients and the public.[12] If we see drawings purely as a means of representing architecture on a two-dimensional surface, technique becomes more important than purpose. With the exception of medieval paintings, where architecture was used to provide narrative context for human figures,[13] this has changed little since classical times.

As two-dimensional representations of architectural objects, these drawings combine highly abstract icons into an easily understandable, geometrically based code. Because they convey so much information and are universally understood, they are superior to language as a form of description, and are in theory easy to read, regardless of their historical provenance.[14]

Architects use three ways to explain their work to others: plan, section, and elevation. Of these, the plan is undoubtedly the most important. The oldest surviving medieval architectural drawing is the famous ninth-century Plan of St Gall, depicting an unbuilt ideal monastery. Werner Jacobsen has shown that this was not simply a factual record, and the plan was worked out by trial and error on the parchment.[15]

9 Project by Bibliotheca Hertziana, Rome: http://lineamenta.biblhertz.it/; project by Deutsche Fotothek Dresden: *http://www.deutschefotothek.de/?ARCHIV_ARCHITEKTUR;* project by TU Berlin: *http://www.architekturmuseum-berlin.de.*

10 For example: Heinrich Wurm: *Baldassare Peruzzi. Architekturzeichnungen*, hardcover edition, Tübingen 1984; *Michelangelo e il disegno di architettura*, Centro Internazionale di Studi di Architettura Andrea Palladio a cura di Caroline Elam, Venice 2006; François Fossier: *Les dessins du fonds Robert de Cotte de la Bibliothèque nationale de France: Architecture et décor*, Paris 1997; Helge Bofinger and Wolfgang Voigt (eds.): *Helmut Jacoby. Meister der Architekturzeichnung*, Tübingen 2001.

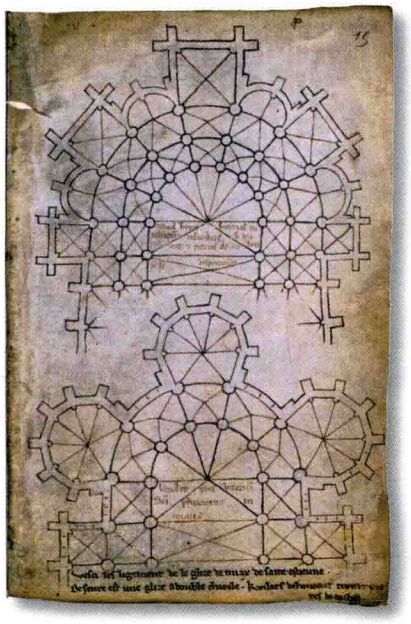
11 See Roland Recht: *Le Dessin d'architecture. Origine et fonctions*, Paris 1995. This is simply a collection of essays on medieval and Renaissance architectural drawing, as is the volume edited by James S. Ackerman and Wolfgang Jung, *Conventions of Architectural Drawing: Representation and Misrepresentation*, Cambridge, Mass. 2000, which contains essays mainly on issues of modern architectural drawing. On the problem in general: Margaret Richardson: 'Architectural drawings, problems of status and value', in: *Oxford Art Journal*, 5,2, 1983, pp. 13–21; Werner Oechslin: 'Rendering – Die Darstellungs- und Ausdrucksfunktion der Architekturzeichnung, in: *Daidalos*, 25, 1987, pp. 68–77.

12 Kieven 1993, Von Bernini bis Piranesi, p. 9.

13 Wolfgang Kemp: *Die Räume der Maler. Zur Bilderzählung seit Giotto*, Munich 1996.

14 Hans W. Hubert: 'Architekturzeichnung', in: *Enzyklopädie der Neuzeit*, vol. 1, Stuttgart 2005, pp. 614-624.

15 Werner Jacobsen: *Der Klosterplan von St. Gallen und die karolingische Architektur. Entwicklung und Wandel von Form und Bedeutung im frankischen Kirchenbau zwischen 751 und 840*, Berlin 1992.



Villard de Honnecourt:
Plan of Meaux Cathedral (bottom),
Imaginary plan (top), c. 1230
Source: Bibliothèque nationale de France, MS Français 19093, fol. 15

The compass holes are visible, and the draftsman scored out various ideas with a sharp object, rejecting these before eventually drawing the final version in red ink. Jacobsen also shows that the dimensions on the plan correspond to those of the completed building, so the drawing was very much a construction plan, serving as a *pars pro toto* of the whole building.

The importance of the plan as a description of the design and its execution is apparent in later medieval drawings.[16] The rough line drawings in the sketchbook of the thirteenth-century travelling architect Villard de Honnecourt were records of existing buildings, though he and his colleagues also used schematic plans to design new ones.[17] Compared to the Plan of St Gall, which includes many inscriptions detailing the contents and functions of the various rooms, Villard's plans concentrate solely on the architecture: his drawing of Meaux Cathedral, for example, uses crosses to represent the vaulting of the bays, together with the outer walls, buttress and diaphragm arches, and pillars. It would have been very clear to the architect and his colleagues and patrons that this plan showed a church and its elevation,[18] and an educated medieval viewer would have had no difficulty in deciphering and reconstructing the three-dimensional spaces represented by this abstract drawing.

Late medieval plans of important church towers were the culmination of these orthogonal parallel projections. One example is the design for the north tower of the Stephanskirche in Vienna,[19] where more than 16 sections through the steeple are arranged so that a knowledgeable observer could mentally superimpose the plans to visualise the tower's elevation and three-dimensional form. Because they entailed a degree of abstraction, the plans assumed a reasonable familiarity with the building or part of a building they depicted, and an ability to knit together countless lines into a solid shape.

Apart from plans, Villard de Honnecourt's sketchbook includes interior and exterior elevations and sections. He did three drawings of Rheims cathedral: the interior and exterior elevations of a bay in the nave, and a section through the buttress of the choir.[20] None of these attempts to explain the spatial relationships between components, and the elevations do not show that some of these components, such as

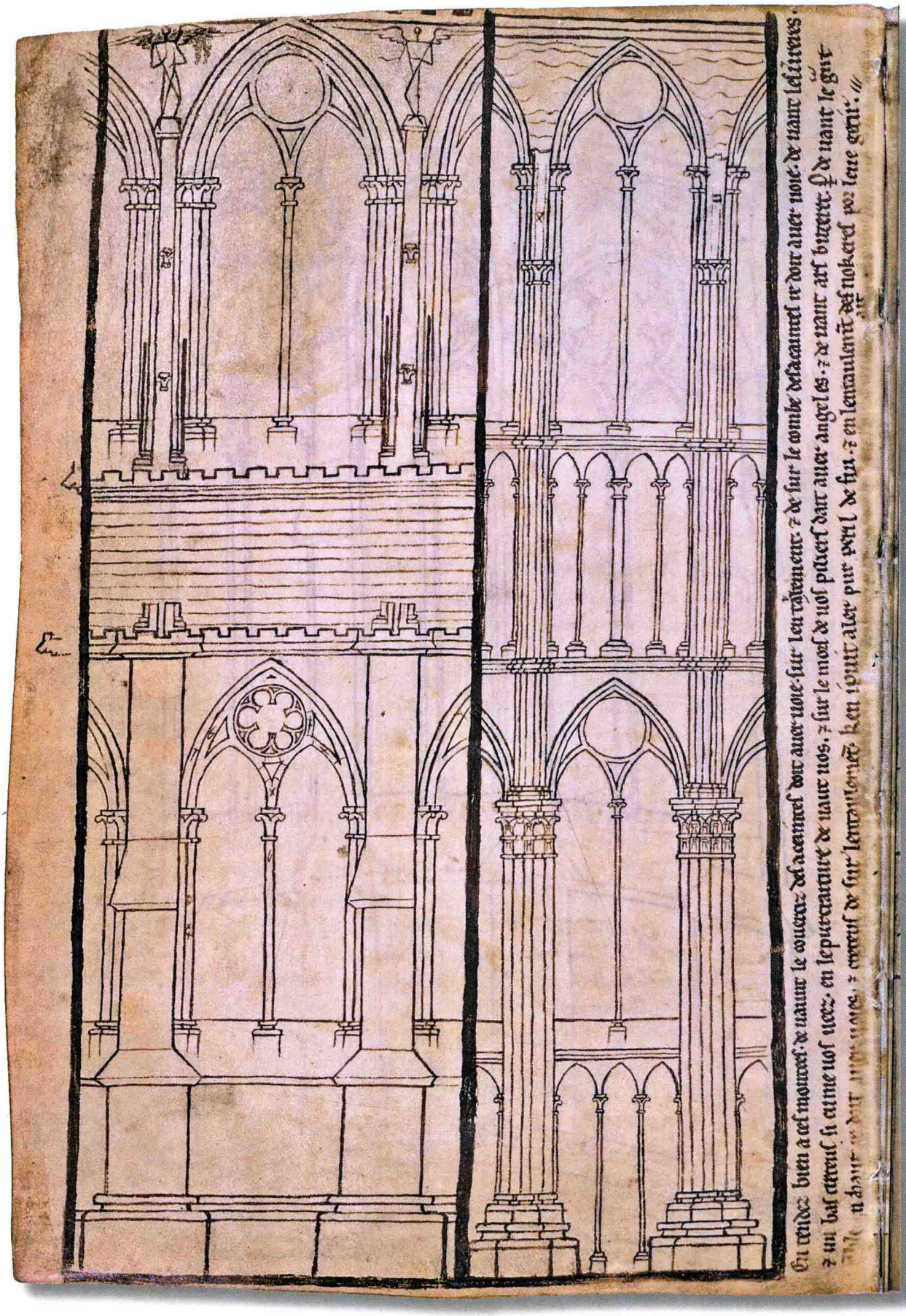
16 James S. Ackermann: 'The origins of architectural drawing in the Middle Ages and Renaissance', in his: *Origins, Imitation, Convention. Representation in the Visual Arts*, Cambridge 2002, pp. 27–65.

17 Wolfgang Schenkluhn: 'Inter se disputando. Erwin Panofsky zum Zusammenhang von gotischer Architektur und Scholastik', in: Franz Jäger and Helga Sciurie (eds.): *Gestalt, Funktion, Bedeutung. Festschrift für Friedrich Möbius zum 70. Geburtstag*, Jena 1999, pp. 93–100; Wolfgang Schenkluhn: 'Die Grundrissfiguren im Bauhüttenbuch des Villard de Honnecourt', in: Leonhard Helten (ed.): *Dispositio: der Grundriss als Medium in der Architektur des Mittelalters*, Halle 2005, pp. 103–120.

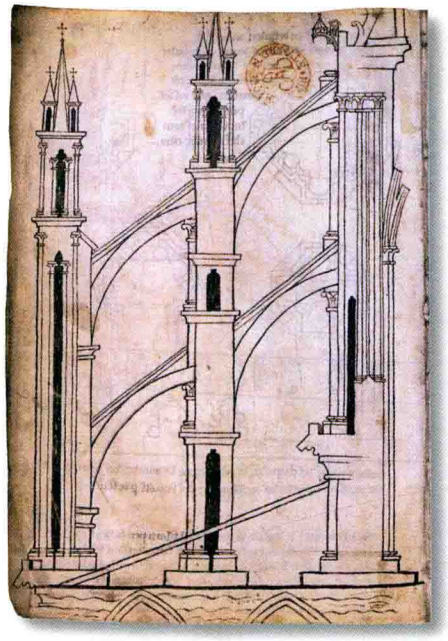
18 This is apparent in my reconstruction of the design history of the collegiate church in Mons: Klaus Jan Philipp: 'Sainte-Waudru in Mons. Die Planungsgeschichte einer Stiftskirche 1449–1450', in: *Zeitschrift für Kunstgeschichte* 52, 1988, pp. 372–413.

19 Böker, *Architektur der Gotik*, p. 176 (inv. no. 16.872v) and 421 (inv. no. 105.064).

20 Villard's sketchbook also contained two 'perspective' drawings of the choir chapel interior and exterior.



Villard de Honnecourt: Interior and exterior elevations of a bay in the nave of Rheims Cathedral, c. 1230
Source: Bibliothèque nationale de France, MS Français 19093, fol. 31 v



Villard de Honnecourt: Section through the buttress of the choir, Rheims Cathedral, c. 1230
Source: Bibliothèque nationale de France, MS Français 19093, fol. 32 v

pillars, are arranged at specific distances from others, such as the wall of the side aisle. Rather, Villard is interested in the measurable relationships between them. His purpose is not to create a perspective view of the space occupied by the cathedral,[21] and he avoids any attempt at reproducing depth, for example by using undulating lines to show a section through the curved cells extending into the space. This denies any sense of space, and says nothing about the position of the section, as it is not clear from where Villard drew the side or interior elevations. In this way, his views have the same objectivity as that of the plan.

In contrast, the 'perspective' drawings of the choir chapel at Rheims Cathedral and the spire of Laon Cathedral are subjective depictions of architecture, with no measurable and objective depth. Those in Villard de Honnecourt's sketchbook are unusual among medieval architectural drawings, which were almost always orthogonal. In his treatise opposing the use of perspective drawing in architecture, Leon Battista Alberti supports this practice: 'While the painter uses fine shadows, lines and angles to create relief on the flat surface of the picture, the architect is not interested in shadow, but uses the plan to show the verticals. He wishes his work to be judged not on the appearance of perspective, but on the true *divisio* (the wall), based on the *ratio* (in other words, measurable relationships).'[22]

The 'untrue' nature of perspective architectural drawing was a constant subject of theoretical debate. Even today, we see a continual succession of new techniques and technologies – central perspective, photography, cinema, CAD, Photoshop, 3D animation – which expands the space that can be experienced by the senses. For the purposes of presenting architectural designs, however, the elevation and section in parallel orthogonal projection and the plan, defined as 'a view from above of the lower part of a building cut through horizontally,'[23] are defined in DIN 1356-1. The standard does not cover perspective, axonometric, isometric or other forms of representation,[24] although graphic representation uses them. It ultimately employs the same types of projection as those used in the Middle Ages, in some ways justifying the provocatively ambitious title of this article – though it would not be true to say that this continuity has remained unbroken to the present day.

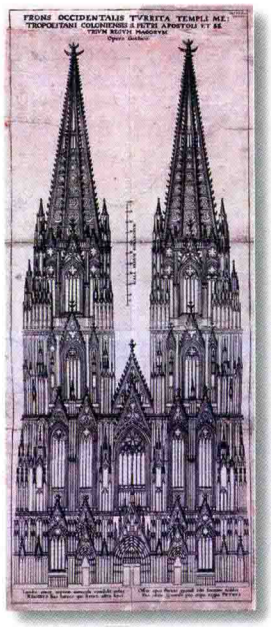
The history of architectural drawing would indeed be brief if artists and architects had not continually sought out types of projection that went beyond the objective and schematic. Even in the Middle Ages, they knew that construction drawings need not be simple depictions of planned or existing buildings. Bruno Klein, for example, has argued convincingly that the famous Strasbourg cathedral facade plan 5 is

21 Wolfgang Lotz: 'Das Raumbild in der italienischen Architekturzeichnung der Renaissance', in: Mitteilungen des kunsthistorischen Instituts Florenz, 7, 1956, pp. 193–226.

22 Cited in ibid. p. 194.

23 DIN 1356-1:1995-02, p. 3, paragraph 4.3.1. As an alternative, 4.3.2 offers a mirrored view from beneath the upper part of a horizontally sectioned building.

24 In the case of DIN 1356-1, this is represented by a building model by the American architect Charles Gwathmey.



Cologne Cathedral: Elevation of the completed western facade. Etching from: Hermann Crombach, Primitiarum Gentium Seu Historia Ss Trium Regum Magorum, tomi III. Cologne, 1654, p. 800
Source: Kölnisches Stadtmuseum – Rheinisches Bildarchiv

not a real architectural design.[25] This impressive parchment drawing, probably dating from between 1341 and 1371, and measuring 4.1 metres high by 82 centimetres wide, was produced when the clock tower on the western facade was being built. It was intended to convince the cathedral's masons' lodge of the need for the tower, and of the beauty of the structure.

The rise of architectural drawing in the thirteenth century probably resulted partly from the fact that building projects involved a growing number of decision-makers. It was therefore important that the plans be easily understood by laypeople, so that they could see what the architect wanted to build. In facade plan 5, for example, the complex filigree architecture of the belltower could not have been constructed in real life – but practical feasibility was not the greatest of the architect's concerns: he wanted the plan to impress his patrons, and was not averse to a little artistic licence. The unusually ornate plan and its beautifully coloured figures served to distract laypeople from the issue of whether the tower was actually possible, and impress them with its beauty. Probably for the first time in the history of architectural drawing, facade plan 5 was a work of fiction. Its purpose was to seduce, and it was a forerunner of the many drawings produced largely for persuasive purposes during the seventeenth and eighteenth centuries. Even in the fourteenth century, before any theories were set down in writing, architectural drawings included fictitious elements. The Gothic and Italian Renaissance periods produced the earliest professional architectural drawings of structures intended to be built, containing all the key elements of their modern counterparts, including orthogonal projection, scale, and concordance between plan and elevation.[26]

The rediscovery of Vitruvius' *Ten Books on Architecture* resulted in many innovations. As in many other cases, his definition of the different forms of *dispositio* played a fundamental rolepart in subsequent discussion of architectural drawing: 'The forms of *dispositio*, which the Greeks call ideas, are *ichnographia, orthographia,* and *scaenographia. Ichnographia* is a reduced-scale plan, made with a ruler and compass, used to show the outlines of the different parts of the building on the ground. *Orthographia* is an upright frontal view, again a small-scale version of the future building's dimensions. And *scaenographia* is the perspectivist, illusionistic depiction of the facade, the receding sides, and the lines converging on a point.'[27]

But Vitruvius' original text is not always easy to understand, and the concept of *scaenographia* was the subject

25 Bruno Klein: Der Fassadenplan 5 für das Straßburger Münster und der Beginn des fiktiven Architekturentwurfs, in: Stefanie Lieb (ed.): *Form und Stil. Festschrift für Günther Binding zum 65. Geburtstag*, Darmstadt 2001, pp. 166–174.

26 Böker, *Architektur der Gotik*, p. 27; Böker is primarily correcting Wolfgang Lefèvre: 'The emergence of combined orthographic projections', in: Ders. (ed.): Picturing machines 1400–1700, Cambridge, Mass., pp. 209–244.

27 Vitruvius I, 2,2: 'Species dispositionis, quae graece dicuntur ιδεαι [ideas], sunt haec: ichnographia, orthographia, scaenographia. Ichnographia est circini regulaeque modice continens usu, e qua capiuntur formarum in solis arearum descriptiones. Orthographia autem est erecta frontis imago modiceque picta rationibus operis futuri figura. Item scaenographia est frontis et laterum abscedentium adumbratio ad circinique centrum omnium linearum responsus.' See also Maria Teresa Bartoli: 'Orthographia, ichnographia, scaenographia', in: *Studi e documenti di architettura*, 8, 1978, pp. 197–208.