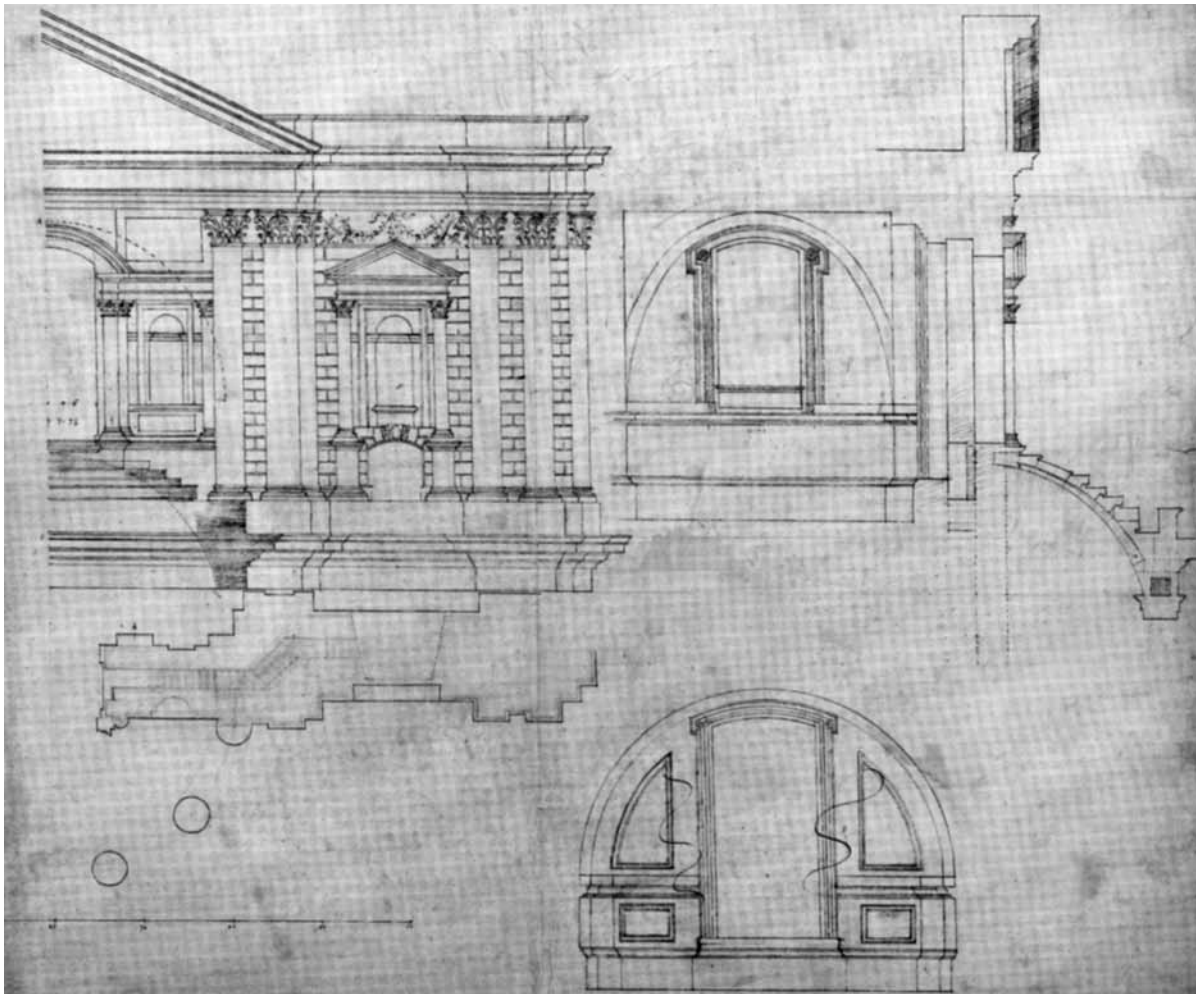
From Renaissance treatise to virtual reality, representations are examined for their capacity to attract attention and convey meaning, to jaded aristocrats or image saturated students.

Opening technology's door: perils and possibilities

Nicholas Adams

While waiting for class two years ago one of my students looked at the back of the room where two unused slide projectors stood. 'But', he wondered out loud – having no history of comparative slide projection – 'how come you have two of them?' His remark speaks directly to the rapid change from print to pixel and about the transformation of the lecture room, the place where this change has been most sharply felt: pixels are our daily habit, our night-time curse, and our weekend distraction. It is never-ending. The great historian of technology Lynn White observed that technology opens doors but compels no one to walk through them.[1] He might have rethought that statement were he still teaching, for the practical transformation has been radical: to resist digital technology is tantamount to professional suicide.[2]

At one time the nature of our presentations in architectural history was, more or less, a given. One could debate the use of Ektachrome, Agfa or Fujichrome slides, but the limitations of clarity generally meant image only. Text additions could be



1 Unidentified draughtsman with Nicholas Hawksmoor, study for the upper transept end, St. Paul's London (1685–86). The left half of the sheet shows half of the second-storey elevation along with its associated ground plan

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managed by those with draughting skills but were relatively rare. Dry transfer products such as Zip-A-Tone (1937), Chartpak (1949) and Letraset (1966) could help make one's points, but even they required a steady hand and some graphic sensibility. Best of all, was a good clear image from a book that could be reproduced effectively in slide form. All too frequently, however, the image legible in the book, legible close up in one's hand, lost clarity when it filled half of the screen. For some a long stick sufficed to point out significant details and direct the attention, for the more adventurous an electric pointer could facilitate the reading of an image. If you were lucky you could persuade someone in the audience to highlight a point with one of these points while you held the 'advance' mechanisms for the slides. An audience needed to concentrate, sometimes mentally transforming an image that the speaker could not provide from the desired angle, sometimes mentally obliterating later additions or distractions. It was hard work. Today the manipulation offered by digital technology with its debts to film and television solves most problems of representation: most things can be removed using Microsoft Photoshop's 'proximity tool'. You can even turn the screen into a *son et lumière* with lively transitions and sound effects. All of which is to say that the door through which we entered is turning out to be – to mix metaphors egregiously – a Pandora's Box. The struggles taking place on computer desktops and lecture screens are not only about the image, but a free-for-all between word and image, sound and silence, moving and still. Sorting out this will take time.

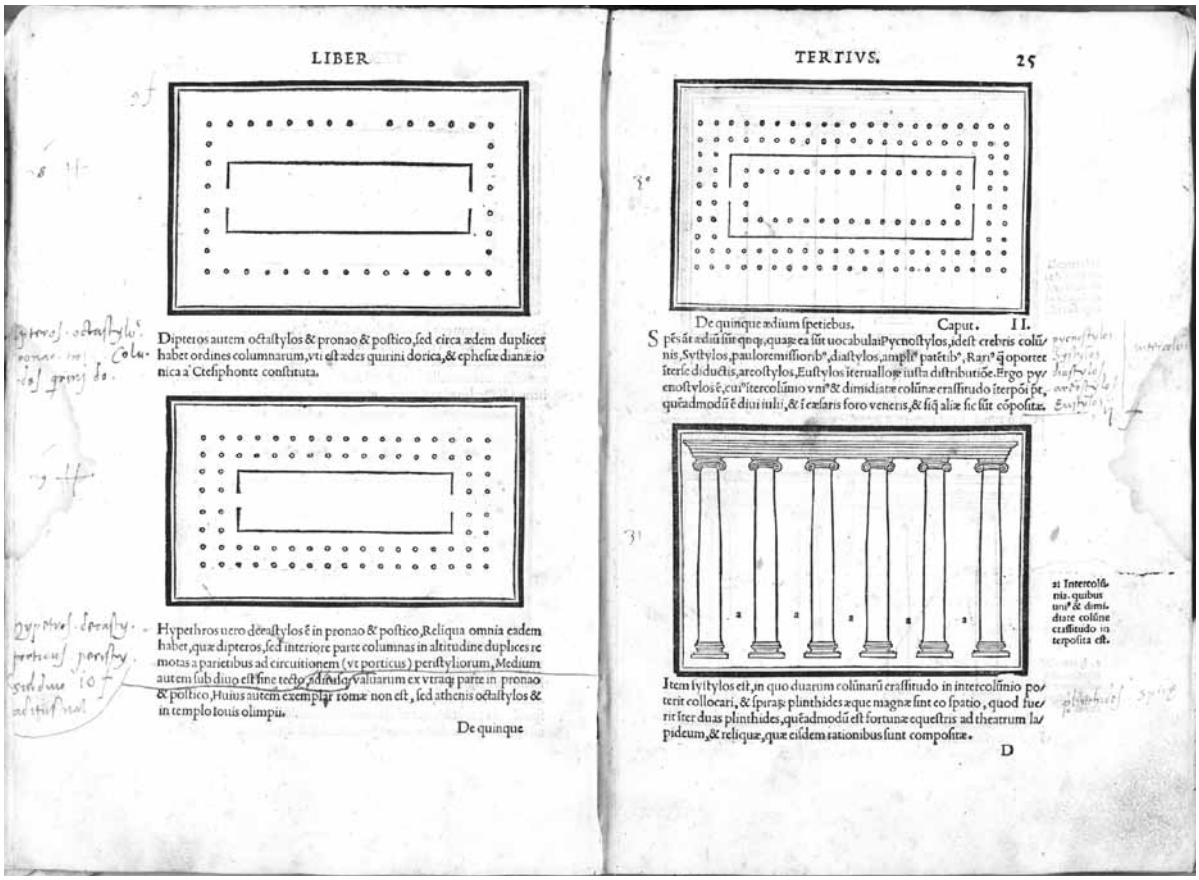
Movement

For appreciating architecture, movement is essential. Buildings are experienced in movement and their form is the product of a programme that foresees the movement of people through the building. Because teachers of architecture are educating a cohort raised on television and video games and screaming heads they expect a hot media, emotionally charged, and dramatic. In the trailer for the Public Broadcasting Service (USA) series, 'Building the Great Cathedrals', the narrator asks: 'How did medieval engineers construct magnificent skyscrapers of glass and stone?', and the film shifts between scholarly commentary and explosive detail. To the on-screen comment of one of the presenters, 'this building takes off like a rocket ship', the trailer quickly cuts to what may be the blast-off plume from a real rocket or the sparks flying from an anvil. On YouTube you can see slick evocations of the medieval world next to which the still images in our textbooks seem dull and cold, like the engravings from Paul Marie Letrouilly's *Edifices de Rome Moderne* (1860) compared with a bright colourful photograph.[3] An image that doesn't move is a boring image; getting students or museum visitors to concentrate for longer than ten seconds on anything at all is a rare skill. To a teenage boy

2 Fra Giovanni Giocondo, *M. Vitruvius per Iocvndvm solito Castigatior Factvs Cvm Figvris et tabvla* (1511)

3 Cesare Cesariano, *Di Lucio Vitruvio Pollione de Architectura Libri Decem traducti de latino in Vulgare* (1521), Book 3, fol. 60

4 Cesare Cesariano, *Di Lucio Vitruvio Pollione de Architectura Libri Decem traducti de latino in Vulgare* (1521), Book 3, fol. 117

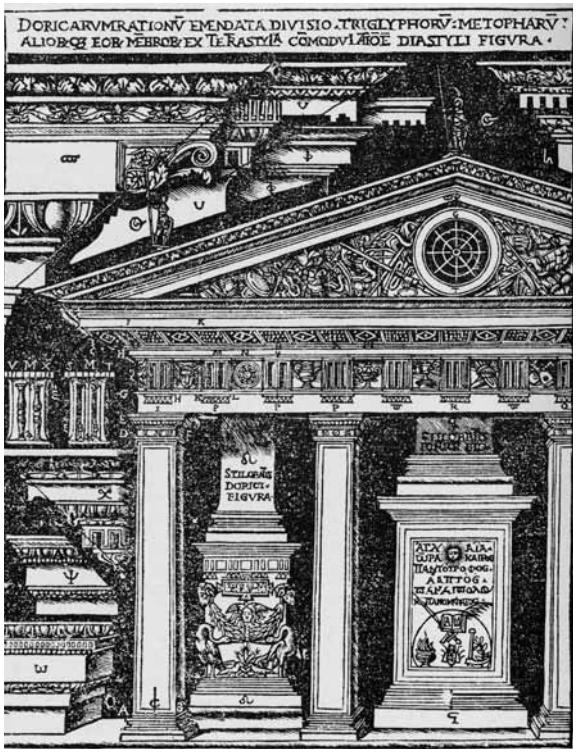


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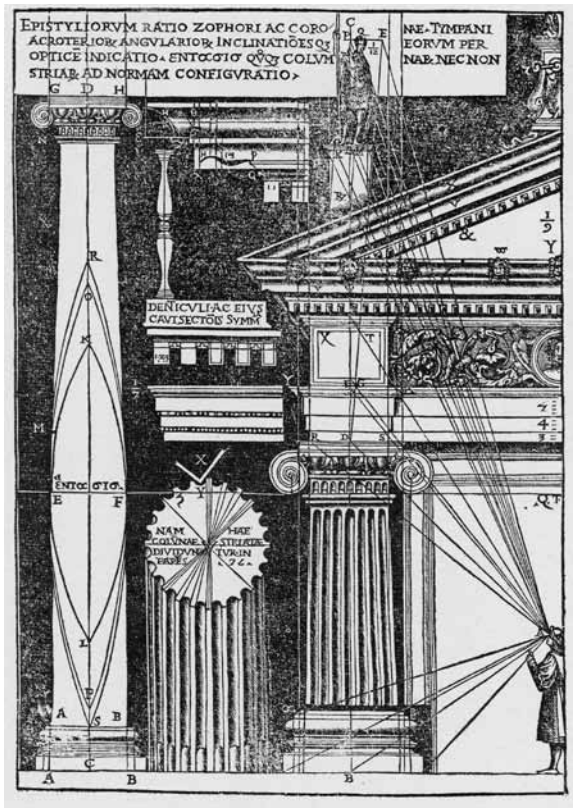
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twenty seconds of silence seems like a lifetime in *clausura* with a group of contemplative religious.[4]

The temptations of movement can overcome good intentions. As part of the exhibition *Compass and Rule: Architecture as Mathematical Practice in England, 1500–1750* (Oxford, Museum of the History of Science, 16 June to 19 September 2009; Yale University, Center for British Art, New Haven, 18 February to 30 March 2010), the curators used the program SketchUp to animate a drawing by Nicholas Hawksmoor for the upper transept at St. Paul's Cathedral in London (1685–86).[5] The left half of the sheet shows half of the second-storey elevation along with its associated ground plan *[1]*. On the right-hand side, the transept and half-dome of the porch appear in section along with the internal elevation of the adjacent clerestory window. It is a complicated sheet and to explain it the curators put this drawing in motion, showing how the different planes of the building described in the drawing relate to one another. Thus planar walls swung in and out of the screen, shifting slowly against one another revealing how the drawing assembled the pieces of the building in a single sheet. Unfortunately, as attractive as the animation was, it significantly misrepresented parts of the drawing: a half column around the Serlian window visible in the plan was turned into a pilaster significantly undervaluing the sculptural quality of the design.[6] It is an immensely clever way to show how the pieces of the drawing mesh together in three dimensions; it does the hard work of looking and interpreting for you. In the exhibition room at the Yale Center for British Art, the moving drawing on screen won hands down over the actual drawing – it was bright and clarifying. In effect, the drawing became redundant illustration to the video.



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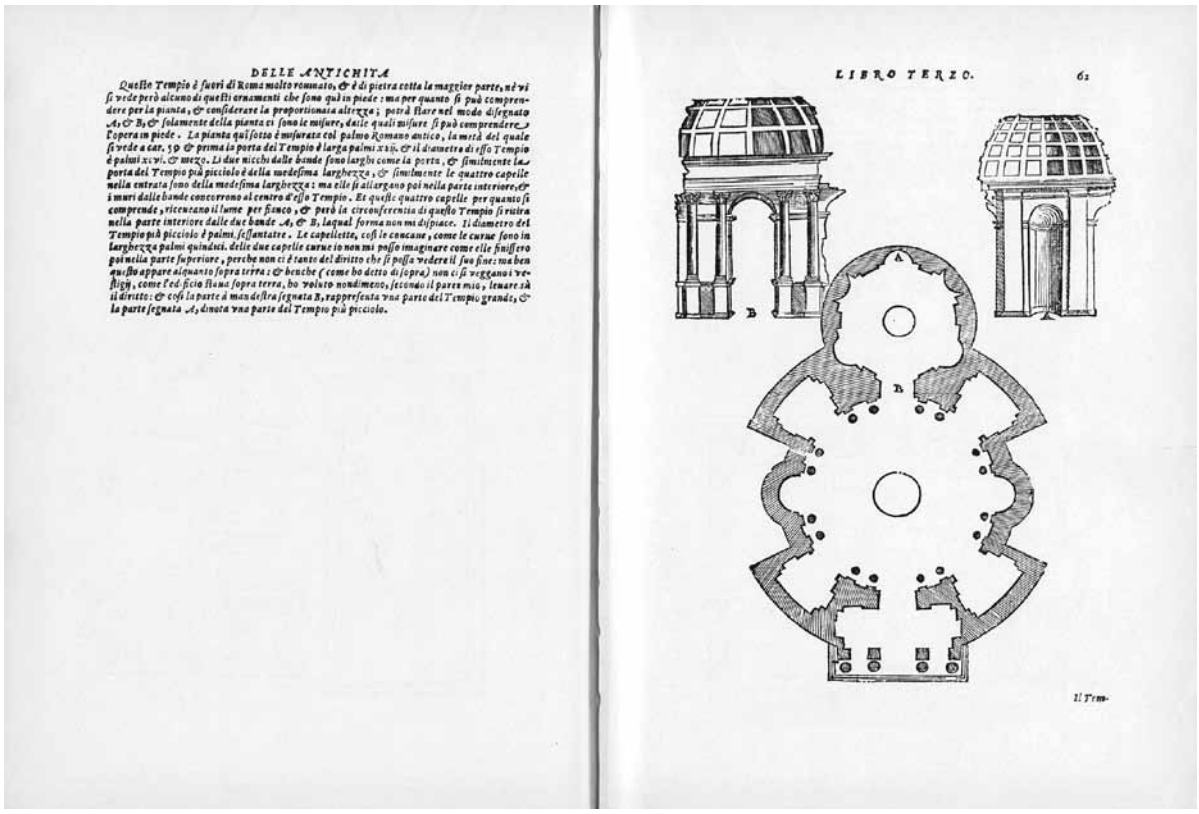
Mastering movement is one of the most troublesome aspects of the new pixellated world. Where once architectural educators and curators did their best against formidable odds, the moving image can resolve these problems. But there is a price to pay for the moving image; it provides a useful summary of the curator's opinion, though the very clarity of the solution closes off interpretative corridors. Moreover the mental muscle, the reconstructive skill, necessary for architects, historians, and students alike, is short-circuited. If the building is only the illustration of an idea, rather than an idea itself, then all the hard work of design is wasted.

Words and images

One of the particular gifts of the new digital world is the ability to offer new ways of presenting words along with images. Overwriting images with text, flying text in to meet an object, sending it in with PowerPoint's sound arsenal is not uncommon. We are not, of course, the first generation ever to consider this problem and returning to history can, perhaps, help clarify the relation between word and image. Without offering a prescriptive lesson in layout, it seems to me that the solutions of the past can illuminate the predicaments of the present. A brief examination of early printed architectural treatises will show how the great print entrepreneurs transformed the image from a simple device for carrying information into an object of contemplation and meditation.

The slow adoption of architecture as subject matter for the new technology of printing might indicate that its presentation in book form offered special problems. Joseph Rykwert reports that half of all printing done before 1500 was devotional; a third was literature in all languages; a tenth was law books

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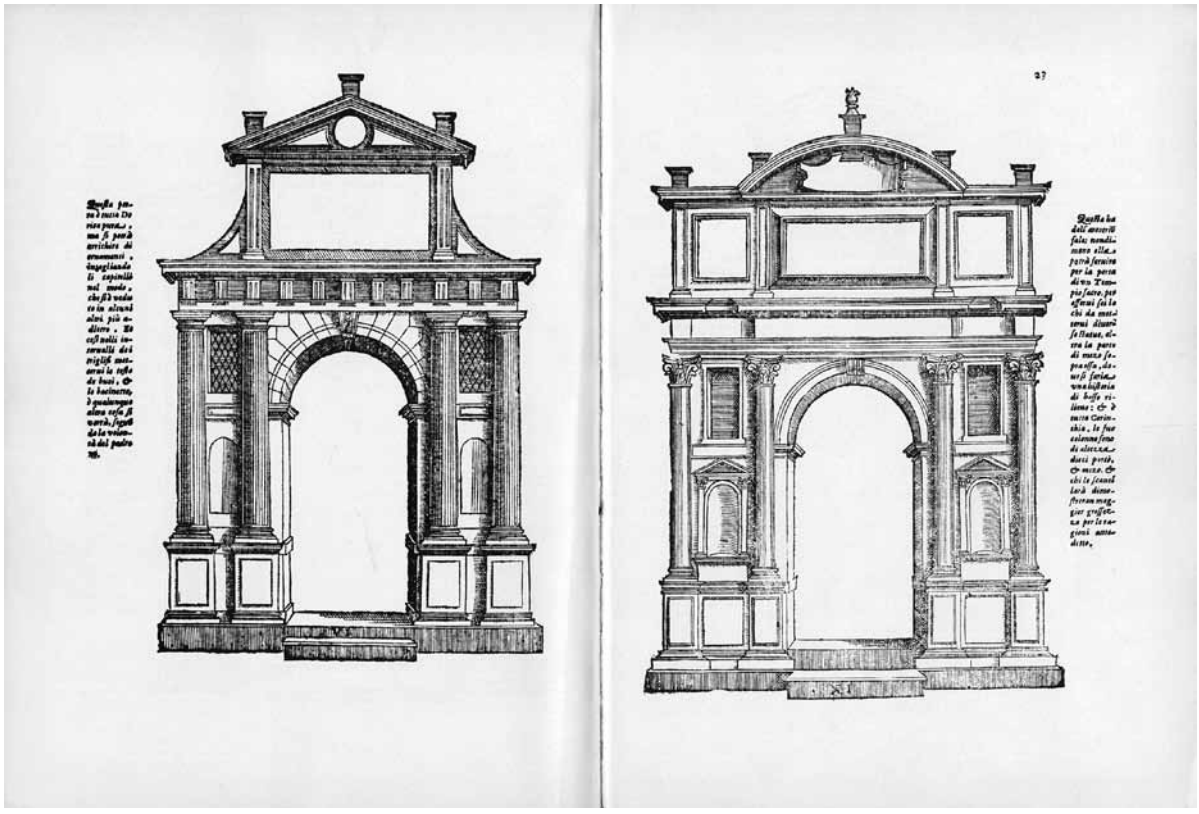


DELLE ANTICHITA

Questo Tempio è fuori di Roma molto rouinato, & è di pietra cotta la maggior parte, nè vi si vede però alcuno di quelli ornamenti che sono qui in piede: ma per quanto si può comprendere per la pianta, & considerare la proportionata altezza; potrà stare nel modo disegnato A, & B, & solamente della pianta ci sono le misure, dalle quali misure si può comprendere l'opera in piede. La pianta qui sotto è misurata col palmo Romano antico, la metà del quale si vede a car. 59 & prima la porta del Tempio è larga palmi xxii. & il diametro di esso Tempio è palmi xvi. & mezo. Li due nicchi dalle bande sono larghi come la porta, & similmente la porta del Tempio più picciolo è della medesima larghezza, & similmente le quattro capelle nella entrata sono della medesima larghezza: ma elle si allargano poi nella parte interiore, & i muri dalle bande concorrono al centro d'esso Tempio. Et queste quattro capelle per quanto si comprende, riceueano il lume per fianco, & però la circonferentia di questo Tempio si ritira nella parte interiore dalle due bande A, & B, laqual forma non mi dispiace. Il diametro del Tempio più picciolo è palmi sessantatre. Le capelette, così le concane, come le curue sono in larghezza palmi quindici. delle due capelle curue io non mi posso imaginare come elle finissero poi nella parte superiore, perche non ci è tanto del diritto che si possa vedere il suo fine: ma ben questo appare alquanto sopra terra: & benche (come ho detto di sopra) non ci si veggano vestigij, come l'edificio stiano sopra terra, ho voluto nondimeno, secondo il parer mio, leuare sù il diritto: & così la parte dimostra segnata B, rappresenta una parte del Tempio grande, & la parte segnata A, dinota una parte del Tempio più picciolo.

Il Tem-

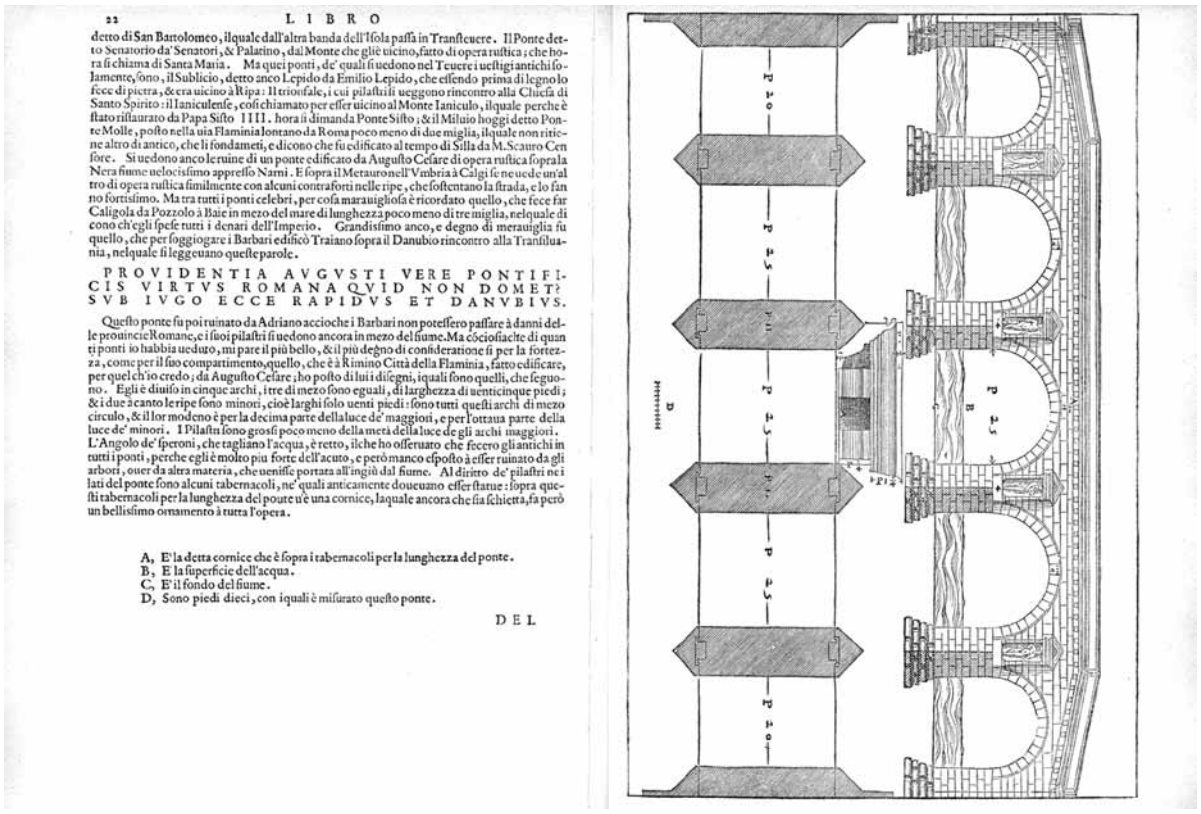
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– which leaves a tenth dedicated to everything else. It is odd, Rykwert observes, given the passionate interest in architecture among the upper classes, that it was not more consistently represented in printing.[7] Perhaps they remained attached to the hand-lettered and drawn manuscript? Perhaps the taste for architectural drawing needed to reach a critical level, sufficiently well diffused for architects to find an advantage in the new technology?[8] It is interesting that in the second half of the fifteenth century someone like Francesco di Giorgio (1439–1502) who produced 'treatise' after 'treatise' with technical illustrations and perspective sketches, but all in manuscript form, never found a way to translate his manuscripts onto the printed page.[9] The first thoroughly illustrated printed architectural

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detto di San Bartolomeo, il quale dall'altra banda dell'Isola passa in Transteuere. Il Ponte detto Senatorio da' Senatori, & Palatino, dal Monte che gliè uicino, fatto di opera rustica; che hora si chiama di Santa Maria. Ma quei ponti, de' quali si uedono nel Teuere i uestigi antichi solamente, sono, il Sublicio, detto anco Lepido da Emilio Lepido, che essendo prima di legno lo fece di pietra, & era uicino à Ripa: Il trionfale, i cui pilastri li ueggono rincontro alla Chiesa di Santo Spirito: il Ianiculense, così chiamato per esser uicino al Monte Ianiculo, il quale perche è stato rissaurato da Papa Sisto IIII. hora si dimanda Ponte Sisto; & il Miluio hoggi detto Ponte Molle, posto nella uia Flaminia lontano da Roma poco meno di due miglia, il quale non ritiene altro di antico, che li fondamenti, e dicono che fu edificato al tempo di Silla da M. Scauro Censore. Si uedono anco le ruine di un ponte edificato da Augusto Cesare di opera rustica sopra la Nera fiume uelocissimo appresso Narni. E sopra il Metauro nell'Vmbria à Calgi se ne uede un'altro di opera rustica similmente con alcuni contraforti nelle ripe, che sostentano la strada, e lo fanno fortissimo. Ma tra tutti i ponti celebri, per cosa marauigliosa è ricordato quello, che fece far Caligola da Pozzolo à Baie in mezo del mare di lunghezza poco meno di tre miglia, nelquale dicono ch'egli spese tutti i denari dell'Imperio. Grandissimo anco, e degno di marauiglia fu quello, che per soggiogare i Barbari edificò Traiano sopra il Danubio rincontro alla Transiluania, nelquale si leggeuano queste parole.

PROVIDENTIA AVGVSTI VERE PONTIFICIS VIRTVS ROMANA QVID NON DOMET? SVB IVGO ECCE RAPIDVS ET DANVBIVS.

Questo ponte fu poi ruinato da Adriano acciochè i Barbari non potessero passare à danni delle prouincie Romane, e i suoi pilastri si uedono ancora in mezo del fiume. Ma còciosiache di quanti ponti io habbia ueduto, mi pare il più bello, & il più degno di consideratione si per la fortezza, come per il suo compartimento, quello, che è à Rimino Città della Flaminia, fatto edificare, per quel ch'io credo, da Augusto Cesare; ho posto di lui i disegni, iquali sono quelli, che seguono. Egli è diuiso in cinque archi, i tre di mezo sono eguali, di larghezza di uenticinque piedi; & i due à canto le ripe sono minori, cioè larghi solo uenti piedi: sono tutti questi archi di mezo circulo, & il lor modeno è per la decima parte della luce de' maggiori, e per l'ottaua parte della luce de' minori. I Pilastri sono grossi poco meno della metà della luce de gli archi maggiori. L'Angolo de' speroni, che tagliano l'acqua, è retto, ilche ho osseruato che fecero gli antichi in tutti i ponti, perche egli è molto piu forte dell'acuto, e però manco esposto à esser ruinato da gli arbori, ouer da altra materia, che uenisse portata all'ingiù dal fiume. Al diritto de' pilastri nei lati del ponte sono alcuni tabernacoli, ne' quali anticamente douеuano esser statue: sopra questi tabernacoli per la lunghezza del ponte uè una cornice, laquale ancora che sia schietta, fa però un bellissimo ornamento à tutta l'opera.

A, E'la detta cornice che è sopra i tabernacoli per la lunghezza del ponte.
B, E la superficie dell'acqua.
C, E'il fondo del fiume.
D, Sono piedi dieci, con iquali è misurato questo ponte.

DEL

5 Sebastiano Serlio, *Tutte l'Opere d'Architettura et Prospettiva* (edition, 1619), Book 3, fol. 60v–61

6 Sebastiano Serlio, *Tutte l'Opere d'Architettura et Prospettiva* (edition, 1619), Book 6, fol. 22v–23

7 Andrea Palladio, *Quattro Libri di Architettura* (1570), Book 3, fol. 22–23

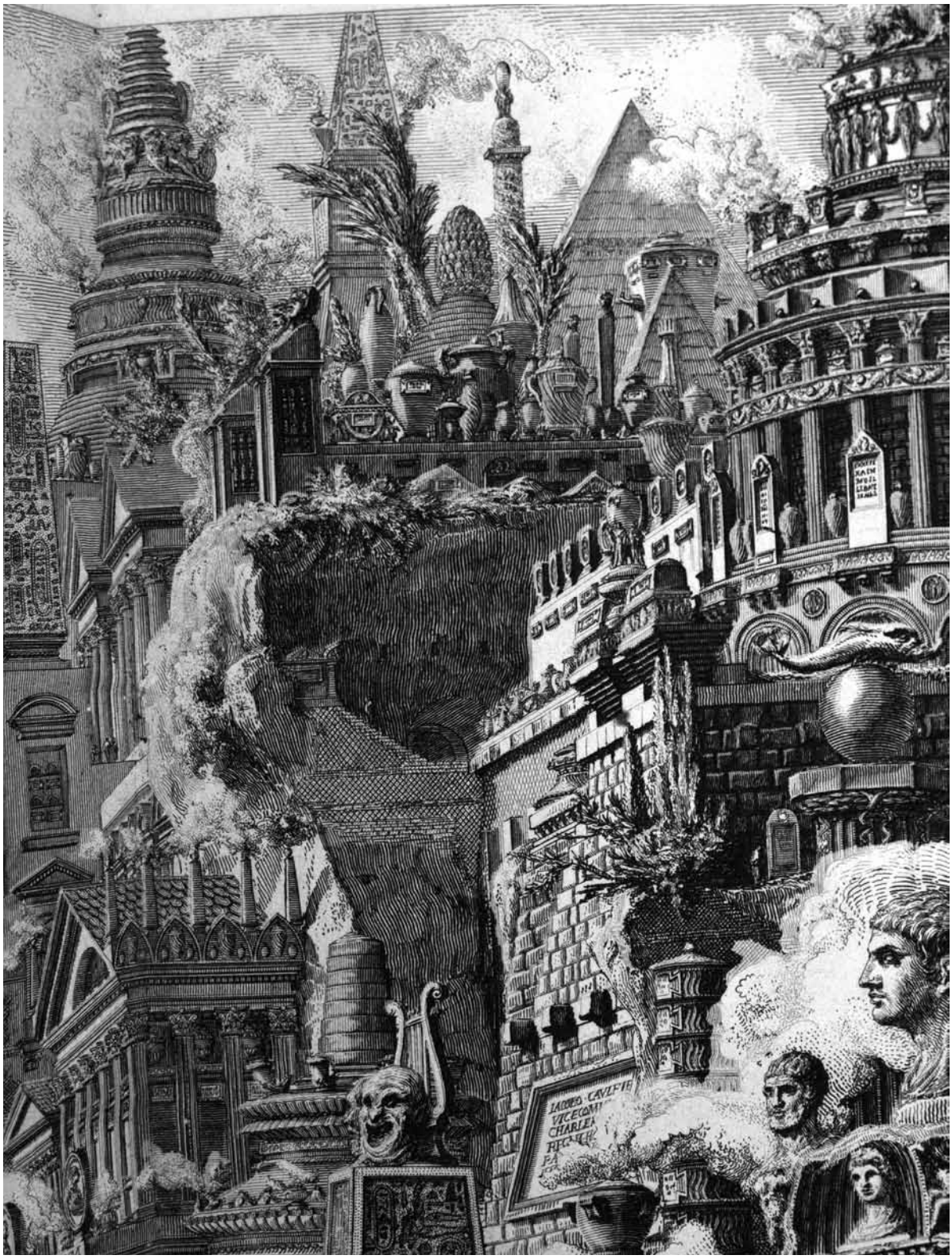
work only appeared in 1511, more than half a century after the invention of printing, when Fra Giovanni Giocondo (1433–1515) produced an edition of the *De Architectura* of Vitruvius with 136 images.[10] Fra Giocondo's history with the printed book is instructive. In 1492 he presented Lorenzo de' Medici with a manuscript of drawings of the ancient buildings and he produced his first printed books only in 1498 when well on in years. It was an edition of Pliny's *Epistles* with new editions in 1504 and 1505. Later he produced editions on the journeys of Amerigo Vespucci, as well as editions of the writings of Victor Aurelius (1504). Those experiences – for they went into multiple editions – may have convinced him that the medium had a future. In the Vitruvius edition his pages have extraordinary clarity *[2]*. At its best the text serves as a caption to an illustration and the occasional addition of a key offers a workmanlike way for the reader to find the details. The barrenness of the pages, their lack of explanation, led Rykwert to argue that an edition like this would have needed expert spoken oral commentary for anyone to make complete sense of it.

Barely ten years later Cesare Cesariano (1475–1543) published a new edition of Vitruvius's text translated into Italian with 117 images making a significant leap forward in visual complexity *[3]*.[11] He divided the text into different blocks to reflect Vitruvius's original and the author's commentary and used the images to explain complex or unclear sections of the text. His representation style became more complex (perhaps too complex?) as images fill pages or slip in between text. Cesariano also uses different projection modes bundled into a single image, for example, to illustrate an ancient entablature. Cesariano's images are sometimes collage-like, cut together in ways that recall our own struggles to bring multiple images together on the screen *[4]*. Cesariano even alternates black and white for the background within the same image, and it is easy to see the virtue of the black background, insufficiently employed in today's digital presentations.[12]

Sebastiano Serlio (1475–1554), who took to printing with an enthusiasm that well exceeded his skills at layout, experimented with a wide variety of representational styles.[13] In the books on architecture that he published, six in total between 1535 and 1545 – one more was published after his death – deep white margins marked the pages where he had no further commentary to make. Perhaps he thought these spaces useful for one's own notes or drawings, or for writing one's own commentary *[5]*. In some instances he blended text and image, like a piece of concrete poetry, so that the text straggles down the page echoing the outlines of image. For Serlio, the largely unreadable text has a defiantly subsidiary position *[6]*.

Andrea Palladio (1508–1580) was the first author to run a single image across the gutter and flow it from page to page. This bravura demonstration of printing skill, the work of the entrepreneurial Venetian printing firm of Domenico de' Franceschi, transformed the architectural book giving new prominence to the image (on one page) and text (the facing page). Even so, the placement of the key for the text occasionally remained problematic and Palladio

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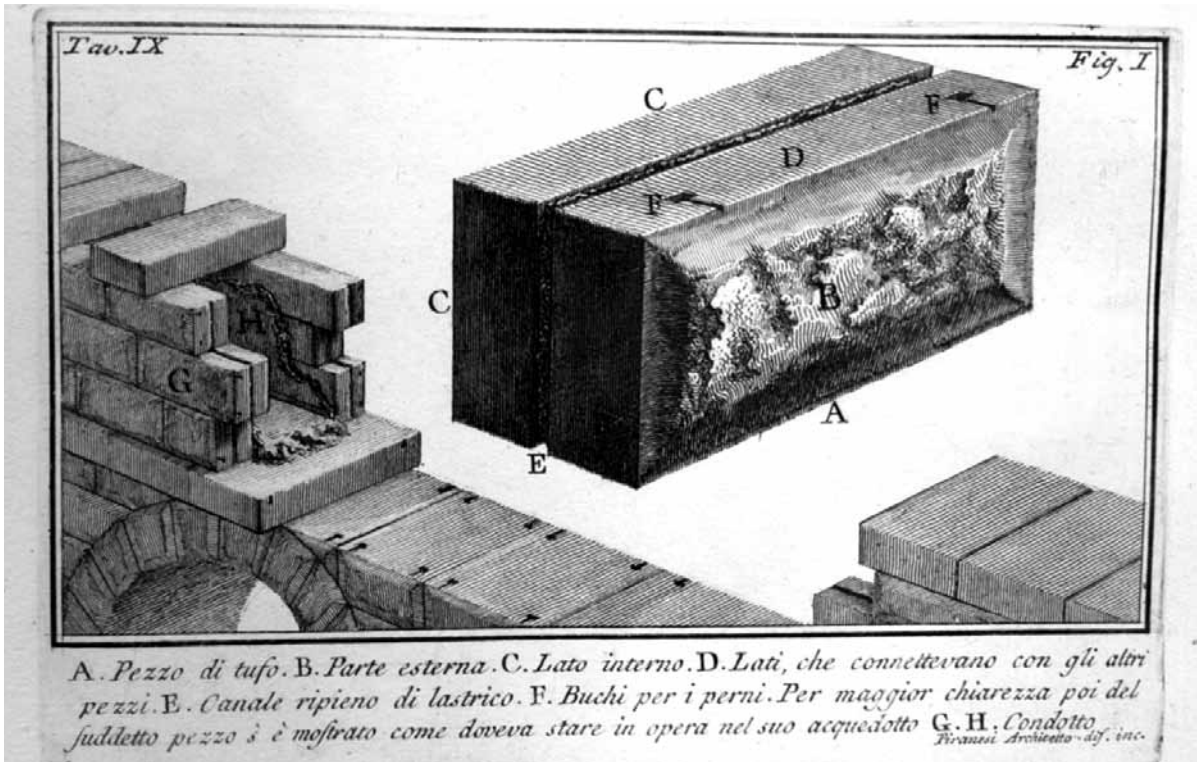


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often asked the reader to rotate the book to follow the argument completely [7]. Only an active reader could take full advantage of text and image. Palladio's seeming indifference to dependable orientation suggests both the fragmented character of study expectations and the limitations of printing technology. Consistent concentration was neither desired nor expected. Each page stood alone, complete within itself, posing its own problems and offering its own solutions.

The great conceptual leap forward in architectural representation comes with Giovanni Battista Piranesi (1720–1778). Trained within the tradition of the *veduta,* minutely detailed large-scale paintings, Piranesi conceived of the experience of looking at the page as a meditative act, a position with which we should sympathise and from which we can learn. Books such as the four-volume *Antichità Romane* (1756) demonstrated how finding evidence within an image by Piranesi is akin to the archaeological site it represents – discoveries are made only after long and close study. On our visual path through an image by

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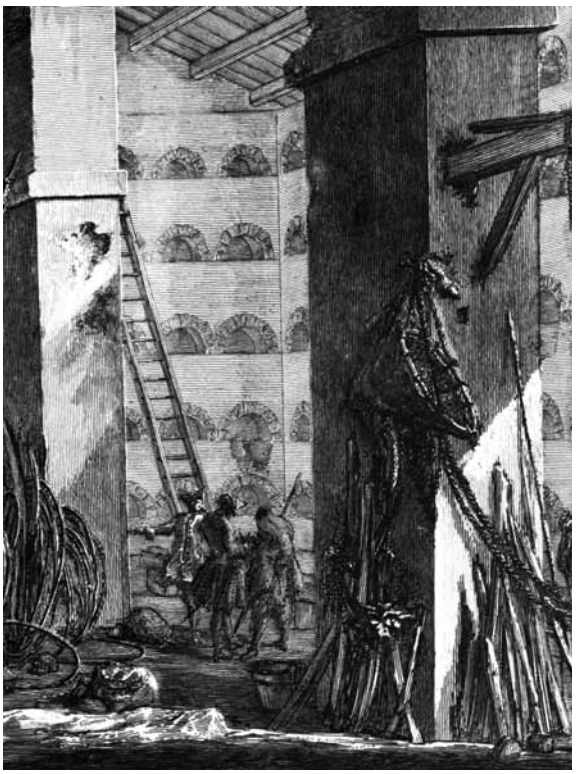
8 Giovanni Battista Piranesi, *Le Antichità Romane* (1784), detail from the Via Appia, vol. 2, pl. 2

9 Giovanni Battista Piranesi, *Le Antichità Romane* (1784), analytic engraving of a tufa block from an aqueduct, vol. 3, pl. 9

10 Giovanni Battista Piranesi, *Le Antichità Romane* (1784), detail, sepulchral tomb of the family of Augustus, vol. 2, pl. 42

Piranesi we don't easily forget the people and objects we meet on the route, the thin, ragged, scarecrow-men who litter the scene, the surprising inscriptions on the tombs. We often peer into the gloom to make sense of the image and the veiled view only increases our powers of attention. What is hidden by the cascading lines of the engraving *[8]*? Like the earlier authors the letter key provides elucidation of the image, indeed it becomes the device by which we fix the identification of these images in our mind. But in some cases even the letter key needs to be discovered by the attentive observer. Piranesi's restraint – he is a provider of memorable (and sometimes polemical) images, not the author of a text book on the ancient world – nonetheless offers us a lesson. Studying image and caption reveals how they complement one another to make the image memorable. This 'dual coding' produces stronger possibilities for memorisation and recall.[14] No wonder Piranesi's images stay with us *[9]*. Even his technical drawings of ancient fragments combine pieces together in a compositional whole that itself merits study. Piranesi's ability to turn an image of the Pantheon, or Basilica of Maxentius, or an entablature in fragments, or a series of tombs, into an object of slow-look meditation is enviable. But isn't this slow looking just what contemporary audiences can't manage?

Although his audience was less different from our classrooms than one might at first imagine – is there any difference between a jaded aristocrat and an over-



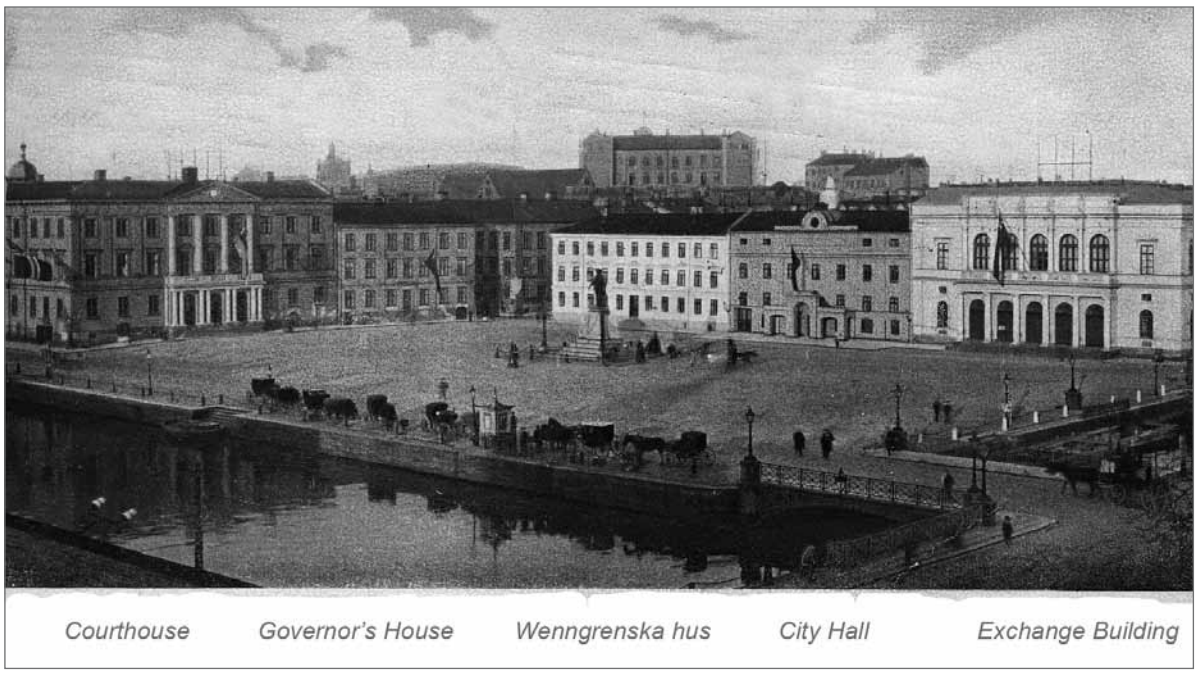
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indulged undergraduate? – Piranesi recognised the dangers of boring images, and found ways to decorate his page providing levels of secondary interest that sustain and nourish the focus rather than distracting the viewer. Looking becomes an integral part of the pleasure of study *[10]*. Slow looking also reveals the ingeniousness of the artist's construction; and the artist's construction holds our attention. Even though the images of Piranesi don't move, in my experience, teaching Piranesi is akin to offering a group of college students the irresistible

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11



12

11 Gustav Adolf's square in Gothenburg, postcard ca. 1910

12 Gustav Adolf's square in Gothenburg, postcard ca. 1910, with the identification of the buildings around the square

chance to play with puppies and kittens. Finally Piranesi's images of the Roman antiquities offer a constructed representation of reality that is nothing like actuality, but that is wholly convincing in its details and fascinating in particulars. For centuries, looking at Piranesi was the equivalent of being there, maybe better. These were images in which you could happily spend a long dark evening or a rainy afternoon.

What are the implications of this overview of image presentation for our work in the digital world? In an environment of hot media, people won't sit still as they once did. OK, but are the opportunities for movement so tempting that they need to be taken and grasped on every occasion? How can this be done without distracting viewers from the thing that needs to be explained? How can it be done in a way to reinforce learning, proffering the pleasure of sustained concentration.

Keeping in mind the combination of text and image that Piranesi used to make images memorable I want to raise two issues of presentation and one significant and related problem.

1) For most people (and certainly most non-Swedish people) Gustav Adolf's square in Gothenburg is *terra incognita.* It is, however, the central representational square in the second city in Sweden. Laid out under the direction of the king, Gustav Adolf II, starting in 1621, it is a regal square in its dimensions surrounded by a somewhat motley collection of buildings. The image of the square comes from a postcard from around 1910 *[11]*. Probably none of the buildings is familiar to you and one's ability to single out any one building is limited.

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And yet it is an important image for it shows the square before the introduction of Gunnar Asplund's Courthouse Extension in 1934. Evaluation of the architectural character of the square before Asplund's addition helps understand the hue and cry reported extensively in the newspapers of the day that took place when the contractors removed the scaffolding from its facade at the end of October 1936.[15]

Minimal labelling, however, can make the site not only clear but memorable, instantly transforming the unknown and muddled into the clear and knowable *[12]*. It can make the object susceptible to analysis, at the least, if not meditation and contemplation. One's ability quickly to sort out the character of the urban space and one's ability to build comprehension has been immeasurably eased and opened. Faced by something too complicated to grasp, immediately simple labelling – not unlike the best of the treatise writers – enables one to proceed to a discussion at another level.

2) For me, the most promising technique of explanation is QuickTime Virtual Reality (QTVR) that may also be converted into a movie file (.mov).[16] It is comparable to Piranesi's great images in that it provides a similar sense of actuality for a contemporary viewer – even some humour as people moving within the range of the camera often emerge on the screen as ghost-like figures. Looking around a space allows one to explore the relevant and the irrelevant, the warts and all, with the additions (and subtractions) made by everyday users. As a relatively high quality, low-cost and low-tech presentation alternative to video the fascination of controlling movement enhances meditative possibilities and increases the possibilities of concentration. It is not a lazy person's view; although it offers movement, it requires engagement and it represents the real site, not an artificial or constructed view. There are even the chances of accident and secondary details that can, themselves, offer continuing interest. Being there can hold a viewer's attention. In the best of all possible circumstances students can download panoramas, study them for themselves, and come to class prepared with questions or observations about specific locations. In certain circumstances, it may be possible to allow students to control the QTVR in class. Properly managed one can also shoot a soundscape tape to accompany the QTVR, thus making the sound of the space come alive in the classroom.

For example, in explaining Sigurd Lewerentz's church at Björkhagen, outside Stockholm, still photos do a wonderful job at showing the plan and even specific details, but the complexity of the interior resists interpretation and evocation. How to explain the angles of the ceiling beams? How to explain the multiple simultaneous textures the building offers? QTVR places us in space, allows us to control what we see, and allows each viewer to pick out what is important in the context of the class or discussion. Under the right circumstances (with control of the QTVR available to everyone in the room), it is as democratic as can be.

All these new techniques will require new classrooms, new facilities and new skills. They will challenge us to try to hold onto the virtues of 'the actual' and 'the real' in a world that proffers the virtual and the artificial. Is it better to study Platform $9\frac{3}{4}$ or King's Cross Station? Is it to be Harry Potter or High Victorian Gothic?

Still there are significant dangers here, too, leading to one significant problem. Pedagogy was once connected to the book, and with good reason. Books offered the best source of illustrations and a firm, proven and tested, narrative line. Conflicting narrative lines from different books provided the opportunity for analysis and discussion. The temptation now to 'do something because you can', is irresistible but does it make for sound instruction? I *can* explain the urbanistic arrangement in Gothenburg, but what point am I making? Is the point worth making for the audience to which I am talking? Will the presentation enhance their broader understanding? Often enough, the point is less important than it seemed at the time its proof was being constructed. Even QTVR has its dangers. While it is possible to explore every angle of a building, sometimes in striking detail, what is the relation of the QTVR to the long-iconic image in the standard textbook? Can you 'learn' or, perhaps, 'know' a QTVR in the same way as you might a black and white still image; or the building itself? What will stay in the mind after the projector is turned off? Is the QTVR image really the equivalent of being there? Will we also need a soundscape acoustic accompaniment to deepen the experience?

As someone deeply invested in the virtues of memorisation, it gives me something to consider. We have truly passed through the door that technology opened, to reprise the metaphor of Lynn White, and there is no going back. Still, from this side of the door, having crossed the threshold, we need to evaluate coolly what has been gained and what has been lost. Asking the hard questions will, at least, enable us to justify the long hours in front of computer screens.

Notes

1. Lynn White, *Medieval Technology and Social Change* (New York: Oxford University Press, 1966), p. 128. 'As our understanding of technology increases, it becomes clear that a new device merely opens a door; it does not compel one to enter'.
2. Oddly I can count four colleagues who have, over the years, retired from teaching as technology changed. One refused to use email; another was unable to teach architectural design on a computer.
3. The words 'medieval' and 'animation' produces a YouTube hit list of 1130. Some are credibly accurate; others are pure fantasy.
4. See the interesting commentary of Caroline Bruzelius, Duke University, on a senior project to build a virtual (albeit) fanciful cathedral. The project was

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immensely satisfying to the student, but the particular benefit of the project, as noted by Bruzelius on YouTube, is that the student has learned about the linkage between the shifts around the pier and the vaults in the ceiling. As Bruzelius notes, 'they don't think about that unless they have to do it themselves'. She is, of course, absolutely correct about students today. See http://www.youtube.com/watch?v=AW3_Hx6G3Ko (accessed 15 September 2010).

5. See the catalogue, *Compass and Rule: Architecture as Mathematical Practice in England, 1500–1750,* ed. by Anthony Gerbino and Stephen Johnston (London and New Haven: Yale University Press, 2009).
6. I am grateful to the sharp eye of Guido Beltramini for this observation. For the video, see http://www.mhs.ox.ac.uk/compassandrule/kiosk/wren (accessed 16 September 2010).
7. Joseph Rykwert, 'On the Oral Transmission of Architectural Theory', *Les Traités d'Architecture de la Renaissance: Actes du colloque tenu à Tours du 1er au 11 juillet 1981,* ed. by Jean Guillaume (Paris: Picard, 1988), p. 32, pp. 31–48.
8. See, for example, Wolfgang Lotz in *Studies in Italian Architecture* (Cambridge, MA: MIT Press, 1977), pp. 1–65.
9. See Nicholas Adams, 'Knowing Francesco di Giorgio', *Francesco di Giorgio alla Corte di Federico da Montefeltro* (Florence: Leo S. Olschki, 2004), 2 vols, 2: 305–16.
10. Vitruvius, *De Architectura, M. Vitrvvivs per Iocvndvm solito castigatior factvs cvm figvris et tabvla vt iam legi et intelligi possit* ... (Venice: Ioannis de Tridino alias Tacuino, 1511).
11. Vitruvius, *De Architectura Libri dece traducti de latino in Vulgare affigurati: Cõmentati: & con mirando ordine* (Como: Impressa per Magistro Gotardo da Páte, 1511). In 1492 Cesariano presented a manuscript of drawings of the ancient monuments of Rome to Lorenzo de' Medici.
12. On Cesare Cesariano, see Roland Recht, 'Codage et fonction des illustrations: l'exemple de l'edition de Vitruve de 1521', in *Les Traités d'Architecture de la Renaissance: Actes du colloque tenu à Tours du 1er au 11 juillet,* ed. by Jean Guillaume (Paris: Picard, 1988), pp. 61–6.
13. The Venetian edition of Serlio (1663) brings together the various editions. See Serlio, *Architettvra di Sebastian Serlio Bolognese, in sei libri divisa* (Venice: Combi & La Nou, 1663).
14. See Allan Paivio, *Imagery and Verbal Processes* (New York: Holt Rinehart & Winston, 1971).
15. See Michael Landzelius, *Dis[re] membering Spaces: Swedish Modernism in Law Courts Controversy,* Ph.D. dissertation (Gothenburg University: Institute of Conservation, 1999). I am currently preparing a study of Asplund's Courthouse Extension that includes extensive commentary on the newspaper wars over the new building.
16. QTVR requires a tripod, a panorama head, a fish-eye lens, and a normal SLR camera. QTVR panorama and a stitcher program. QTVR can be converted through a number of programs. Pano2Movie is relatively economical (currently 40 Euros).

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Biography

Nicholas Adams is Professor of Art on the Mary Conover Mello Chair at Vassar College, USA. He studied at Cornell Univesity and was awarded his masters and doctoral degrees from the Institute of Fine Arts, New York University. He is the recipient of numerous grants most notably as a member of the School of Historical Studies at the Institute for Advanced Study, Princeton and was a fellow at the American Academy in Rome. His books include *History and the Texture of Modern Life: Selected Essays of Lucy Maynard Salmon* (1853–1927), edited with Bonnie Smith and he edited two volumes of *The Architectural Drawings of Antonio da Sangallo the Younger and His Circle*. His book, *Firearms and Fortifications: Military Architecture and Siege Warfare in Sixteenth Century Siena* co-authored with Simon Pepper, has been translated into Italian. Most recently he published the first independently authored history of the architectural firm of *Skidmore, Owings & Merrill, Skidmore, Owings & Merrill: SOM since 1936*.

Author's address

Prof. Nicholas Adams
Art Department (291)
Vassar College
124 Raymond Avenue, Poughkeepsie
NY 12604
USA
niadams@vassar.edu

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