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Cartographies of Time

Chapter 1: Time in Print (selected passages)

[Image 01.TiP-1: Steinberg, diagram]

What does history look like? How do you draw time?

While *historical texts* have long been subject to critical analysis, the formal and historical problems posed by *graphic representations of time* have largely been ignored. This is no small matter: graphic representation is among our most important tools for organizing information, and as much in the domain of history as in any other.¹ Scholars have developed a rich body of reflection about maps of space, and in the last few decades, many critical theories and histories of cartography have appeared.² By contrast, we have few examples of critical work in the area of what Eviatar Zerubavel has called *time maps*.³ And yet, maps of time are as old and as deeply rooted in western and non-western traditions as maps of space. Because of the very immateriality of time, moreover, maps of time may play an even larger role than maps of space in structuring the way we think about both the past and the present.

In historiography, the idea of time is expressed through a variety of figures, not the least of which is the line. Indeed, in temporal representation in

general, the linear metaphor appears virtually everywhere, in texts and images, and in the many different devices used for the reckoning of time. On an analog clock, for example, the hour and minute hands trace lines through space; though these lines are circular, they are lines nonetheless. The same figure is at work even in digital clocks: here, as George Lakoff and Mark Johnson have argued, the idea of time is signified by the “intermediate metaphor” of numbers as points on a line.⁴ For W. J. T. Mitchell, the notion that time might be thought apart from the spatial metaphor of the line flies in the face of the cultural evidence: “The fact is that spatial form is the perceptual basis of our notion of time, that we literally cannot ‘tell time’ without the mediation of space.”⁵ According to Mitchell, all temporal language is “contaminated” by spatial figures. “We speak of ‘long’ and ‘short’ times, of ‘intervals’ (literally, ‘spaces between’), of ‘before’ and ‘after’—all implicit metaphors which depend upon a mental picture of time as a linear continuum. . . . Continuity and sequentiality are spatial images based in the schema of the unbroken line or surface; the experience of simultaneity or discontinuity is simply based in different kinds of spatial images from those involved in continuous, sequential experiences of time.”⁶ For Western thought, it would seem, time is unthinkable apart from the line.

Understood in the broadest sense, this proposition may well be accurate: the histories of literature and art furnish an abundant store of examples, and, as in the case of the digital clock, in many instances a metaphor that appears to draw its force from a different source in fact bears within it an implicit linear figure. [. . .]

From the most ancient images to the most modern, the line serves as the central figure in the representation of time. The linear metaphor is ubiquitous in everyday visual representations of time as well—in almanacs, calendars, charts, and graphs of all sorts. Genealogical and evolutionary trees—forms of representing temporal relationships that borrow both the visual and the verbal figure of “lineage”—are particularly prominent.⁷

So it comes as something of a surprise to discover that it was only quite recently that scholars first thought to represent chronological relationships among historical events by placing them on a measured, continuous line with a single dominant axis, what we now quite naturally refer to as a “timeline.” This fact is not only surprising in retrospect: in the 1750s and 60s, when this graphic convention was first introduced, observers found it equally strange. Certainly, there was no technical reason why a regular timeline could not have been introduced earlier. Technologies of printing and engraving had long been available, as had techniques for geometrical plotting and projection far more complex than were necessary for this application. What is more, by the eighteenth century, the problem of conceptualizing regular, measured historical time had been a subject of critical reflection for well over a millennium.

[. . .] Every historical culture has devised its own mechanisms for selecting and listing significant events. The Jews and Persians had their king lists; the Greeks, their tables of Olympiads; the Romans, their *fasti*, and so forth. Christian Biblical scholars had argued for centuries over fine points of biblical

chronology and the best way to connect the narratives of the Old and New Testament to those of other peoples.⁸

[Image 01.TiP-2: Marmor Parium from Ashmolean Museum]

Conventional wisdom [. . .] holds that such pre-modern chronologies are but the building blocks of history, a kind of degree-zero of historical knowledge. And, as Hayden White has argued, despite their manifest cultural importance, it has been difficult to induce Western historians to think of them as anything more than this. The traditional account of the birth of modern historical thinking traces a path from the enumerated (but not yet narrated) medieval date lists called “annals,” through the narrated (but not yet narrative) accounts called “chronicles,” to fully narrative forms of historiography that emerge finally with modernity itself.⁹ According to this account, for something to qualify as historiography, it is not enough that it “deal in real, rather than merely imaginary, events; and it is not enough that [it represent] events in its order of discourse according to the chronological framework in which they originally occurred. The events must be not only registered within the chronological framework of their original occurrence but narrated as well, that is to say, revealed as possessing a structure, an order of meaning, that they do not possess as mere sequence.”¹⁰

[Image 01.TiP-3: Annals of St. Gall, r]

[Image 01.TiP-4; Annals of St. Gall, v]

But, as White argues, there is nothing “mere” in the problem of assembling a conceptually coherent visual analogue for history. Like their modern

successors, traditional chronographic forms performed both rote historical work and heavy conceptual lifting. They assembled, selected, and organized diverse bits of historical information along an axis—usually a single axis of years beginning with the Creation or some more recent event and proceeding by uniform intervals thereafter. White argues that to treat such annals as “incomplete” histories misses the point of them entirely. In fact, the form of some medieval annals suggests a sense of historical plenitude that is almost unimaginable today: its aim is not to portray (as we do) the *uniformity* of the flow of time, but rather its *unity* relative to the disunity of events in the world. As White says, in this form, the flow of years itself “signals the ‘realism’ of the account.” For its composer, “The calendar locates events, not in the time of eternity, not in *kairotic* time, but in chronological time, in time as it is humanly experienced. This time has no high points or low points; it is, we might say, paratactical and endless. It has no gaps. The list of times is full even if the list of events is not.”¹¹ As such, it is a text form closely calibrated to both the interests and the historical vision of its users. The same may be said for the chronological tables of the early modern period and the graphic timelines of modernity. Each has a visual structure that addresses particular epistemological interests, and each emerged and flourished in response to specific historical concerns and situations.

[. . .]

In the fourteenth and fifteenth centuries—the period in which our main story begins—European intellectuals began to take a new interest in chronology

in a manner distinct from the concerns of the medieval annalists. In particular, humanists like Petrarch became fascinated by the historical and cultural distances that separated them from the ancient writers whom they admired and from their own posterity. In letters to Cicero and Virgil in the past and to his own future readers, Petrarch carefully indicated the date of his own writing to make clear the length of the interval that separated him from past and future: “Written in the land of the living; on the right bank of the Adige, in Verona, a city of Transpadane Italy; on the 16th of June, and in the year of that God whom you never knew the 1345th.” In setting these chronological distances, he found help in an ancient model: the fourth-century *Chronicle* of the Christian writer Eusebius, translated into Latin by Jerome.¹²

[Image 01.TiP-5: Medieval manuscript of Eusebius, r]

[Image 01.TiP-6: Medieval manuscript of Eusebius, v]

In order to make clear the relations between Jewish, pagan, and Christian histories, Eusebius had laid out their chronologies in parallel tables that began with the patriarch Abraham and the founding of Assyria. The reader who moved through Eusebius’s history, opening by opening, saw empires and kingdoms rise and fall, until all of them—even the kingdom of the Jews—came under Rome’s universal rule, just in time to make the Savior’s message accessible to all of humanity. By matching individual histories to one another and the uniform progress of the years, the reader could see the hand of providence at work.

Eusebius created his visually lucid *Chronicle* just when he and other Christians were first adopting the codex, or bound book, in place of the scroll. Like other Christian innovations in book design, the parallel tables and lucid, year-by-year, decade-by-decade order of the *Chronicle* reflected a more general desire to make the Bible and the various information sources vital for understanding it not only available, but readily accessible for quick reference. The *Chronicle* was widely read, copied, and imitated in the Middle Ages. And it catered to a desire for precision that other popular forms—like the genealogical tree—could not satisfy. As humanists took a new interest in establishing chronological intervals, the book won renewed attention. The fifteenth-century Florentine bookseller Vespasiano da Bisticci—a brilliant impresario of scribal book production—marketed a revised form with great success to scholars and general readers. In the same years that this ancient model of chronological information-processing won renewed attention, Europeans began to print books with moveable type. Historians became interested in the capabilities of the new presses, both for reproducing Eusebius’s work and for ringing changes on its format of parallel columns.

[01.TiP-6A: Eusebius in print]

Many experiments were tried: new kinds of visual organization were developed, and old forms, sometimes long neglected, were adapted for the format of the printed book, but for many centuries, the Eusebian model, a simple matrix with kingdoms listed across the top of the page and years listed down the left or

right hand columns, remained dominant. This visual structure suited the concerns of Renaissance scholars well. Its parallel columns facilitated the organization and coordination of chronological data from a wide variety of sources. It also provided an encyclopedic structure capable of absorbing nearly any kind of data and organizational template, and of negotiating the difficulties inevitable when different civilizations' histories with their different visions and assumptions about time, were fused into a single structure. It was easy to produce and correct, and provided for quick data access—which the printers improved by adding alphabetized indices and other aids. Above all, it still served as a dynamic hieroglyph of providential time. From a graphic point of view, this was the world in a *wunderkammer*, Christian world history in many small drawers.

[. . .] Towards the end of the seventeenth century, technical developments in printing spurred further efforts at innovation, while new techniques of engraving made practical larger and more detailed book illustrations. Some chronologists began to take their cues from cartographers, with visually beautiful results. Ultimately, though, the direct application of the geographic metaphor in the field of chronology proved awkward. Despite great advances in research techniques and the trial of many new forms, representations of time mostly continued to look very much as they had a millennium earlier when the chronographic table first came on line. Space and time turned out to lend themselves to differing visual protocols: the time map was a conceptual

possibility, but its structure would have to be different from that of the geographic map.

It was not until the middle of the eighteenth century that a common visual vocabulary for time maps caught on. When it did, it happened so quickly that it was hard to remember that it had come so late. The key problem in chronographics, it turned out, was not how to visualize historical complexity, but how to simulate simplicity, how to create the effect of uniformity, directionality, and irreversibility in time. And the solution turned out to be lying in plain sight. Rather than increasing the visual complexity of the chronological table in the manner of the seventeenth-century, chronologists during the eighteenth century began to simplify.

[Image: TiP6B: Priestley, Chart of Biography]

In 1765, the English scientist and theologian, Joseph Priestley published his enormously influential *Chart of Biography* in the form of a timeline. At the level of basic technique, there was little in it that was new. The chart was a simple measured field. Along the top and the bottom, dates were measured out like marks on a yard stick. Within the field, horizontal lines indicated when famous historical figures had lived. The lines began at the point of their births and terminated where they died. It was to be a simple, visual correlate for history, a straight, measured, unidirectional line. Yet this proved to be a watershed.¹³

Two vital features made Priestley's design revolutionary. The first was material: by emancipating the timeline from the matrix in which it had originally

shape, enlarging its scale and removing page divisions, Priestley radically clarified its message. Paradoxically, the form first created in Eusebius's *Chronicle*—itself a marvel of clarity in the display of visual information—had to be abandoned for its full graphic potential to be realized. The other was substantive. In addition to its visual effectiveness, the timeline amplified conceptions of historical progress that were themselves becoming popular during the late eighteenth century. Historical thought and new forms of graphical expression came into dialogue, and each had much to offer the other. But Priestley's innovations pointed to a problem too. History had never actually taken the form of a timeline or of any other line for that matter. And simplicity, the great advantage of the form, threatened also to be its greatest flaw. The timeline could function as “the most excellent mechanical help to the knowledge of history” because it could impress the imagination indelibly.¹⁴ For the same reason, a century later, Henri Bergson would refer to the timeline as a deceiving idol.¹⁵

[. . .] Among chronographers, Priestley's solution did not take off everywhere immediately. For decades, the Germans continued to prefer the tabular format, and the French, the hierarchical tree structure popularized by the *Encyclopédie* of Denis Diderot and Jean le Rond d'Alembert. But in Great Britain and its colonies, the results were immediate and widespread, and, by the early nineteenth century, Priestley's timelines had achieved universal success. They had also initiated a series of innovations in the field of statistical graphics including

William Playfair's bar charts and line graphs that would, in their own ways, transform the representation of history.

[. . .] Linear metaphors such as the *stream* of time lent themselves to complex graphic interpretations, and by the middle of the nineteenth century, trees, webs, and other figures were widely employed not only to represent historical sequences but to put in question the epistemological basis of the historical sequence itself. Already in the eighteenth century, writers and artists began to envision non-linear time travels, and during the nineteenth and twentieth centuries, these visions became widespread. Reflection on the question of deep time, too, engendered self-consciously estranging forms of temporal mapping such as the nesting cosmological timelines of the early twentieth-century science fiction writer, Olaf Stapledon.

[Image 01.TiP-7: Stapledon]

During this same period, a countervailing positivist tendency also emerged, especially in the areas in which the study of history interacted most vigorously with science and technology. The development of photography, film, and other new imaging technologies in the nineteenth and twentieth centuries raised new possibilities for recording and re-presenting temporal sequences, and ever more precise scientific instruments made possible the illumination of newly microscopic and macroscopic chronological scales. The simultaneous development of very high speed and very low speed chronological measures at the beginning the twentieth century, such as the chronophotography of Étienne-Jules

Marey and Eadwearde Muybridge on the one hand and the dendrochronology of Andrew Ellicott Douglas on the other, opened new possibilities for the study of the past. They also enlivened the fantasy that historical processes might be directly rather than only metaphorically observed and represented, and deeply influenced the new technics of temporal representation including film and electronic media.

[Image 01.TiP-8: Dendrochronological tree from AMNH]

The influence of chronological questions can still be tracked in recent years, through many ambitious projects to re-envision history by modern and postmodern artists, architects, and designers. George Maciunas of Fluxus and other artists have drawn and commented upon our manners of chronographic practice. In the 1980s and 90s, to take a particularly public example, Maya Lin structured several politically and culturally important monuments, including the Vietnam Veterans' Memorial, the Civil Rights Memorial, and the Women's Table, around different kinds of visual chronology. At the same time, in order to encourage long-term thinking on ecological scales, the Intel engineer, Daniel Hillis, working for the environmentalist Long Now Project, a group committed to encouraging political thinking on the scales of natural history, completed a prototype for the "world's slowest supercomputer," a massive digital clock that ticks only once every year, and that moves only once every one hundred years. Works such as these point both to change and persistence in the problem of chronological representation.

[Image 01.TiP-9: Long Now timeline]

At one level, then, this is a linear story. It is the story of the assertion of the straight, measured line as an effective, and culturally central, figure for time. But, at another level, this is not a linear story at all. In the first place, there is hardly an older figure in existence than the simple line. Linear measurement and even graphing date back several millennia. Early forms of historical representation including the great medieval genealogies of the world use linear representations. Written historical narrative, moving from left to right on the page, or top to bottom, or any direction at all, creates a linear effect. Early forms of historical notation such as chronicles and annals take the form of lists of dates—often regularly distributed lists that give the effect of a regular flow of time. And, while the measured linear figure has become thoroughly naturalized, even today, it is hardly the only one we have available for the representation of time, nor does it function autonomously. A standard calendar, for example, which is linear on the plane of years, is embedded with nested cycles of months, weeks, and days, with a character that is evidently cyclical, and without which we would lose our intuitive sense of the meaning of the historical line itself.¹⁶

Moreover, at every stage in its history, the measured timeline has inspired much theoretical reflection and criticism. After all, it was only one year after the publication of Priestley's *Chart of Biography* that Laurence Sterne began to publish his remarkable satire on linear narrative, *The Life and Opinions of Tristram Shandy, Gentleman*, replete with crooked diagrams mapping the course

of his own story. Priestley saw the timeline as a heuristic, an “excellent mechanical help.”

[Image 01.TiP-10: Sterne, *Tristram Shandy*]

[. . .] For all of their disagreements, the works of both Priestley and Sterne point to the technical ingenuity and the intensity of the labor required to support a fantasy of linear time. Over the course of the 19th and the 20th centuries, the convention of the timeline was progressively naturalized, but its development tended also to raise new questions. In some cases, filling in an ideal timeline with more and better data only pushed it toward the absurd. Jacques Barbeau-Dubourg’s 1753 *Carte Chronologique*, mounted on a scroll and encased in a protective box, was already 54-feet long. Later attempts to re-anchor the timeline in material reference, as in the case of Charles-Joseph Minard’s famous 1869 diagram, *Carte figurative des pertes successives en hommes de l’armée française dans la campagne de Russie 1812-1813*, produced results that were beautiful but ultimately put into question the promise of the modern timeline.

[Image 01.TiP-11: Minard]

The visual simplicity of Minard’s diagram is paradigmatic—as is the numbing pathos of its articulation across the space of the Russian winter. At the same time, through color, angle, and shape, Minard’s chart marks the centrality of the idea of *reversal* in the thinking and telling of history. Minard’s chart may be more accurate than Priestley’s, not because it carries more or better historical detail but because it reads in the complex, sometimes paradoxical way in which a real story

might be told. The same could be said for the branching timeline in Charles Renouvier's 1876 *Uchronie (l'utopie dans l'histoire): Esquisse historique apocryphe du développement de la civilisation européenne tel qu'il n'a pas été, tel qu'il aurait pu être*, depicting both the actual course of history and the various alternative paths that might have been if other historical choices and actions had been taken. And, of course, the twentieth century has seen the development of entire genres of time travel and counterfactual history that develop these same conventions. All of which is to simply to note how very lively and forceful a form the timeline has turned out to be.

[Image 01.TiP-12: Renouvier]

In *Cartographies of Time*, we offer a short account of how the timeline emerged and how it came to embed itself in the modern imagination. In doing so, we hope to shed some light on Western views of history and on the complex relationship between general ideas about the course of events and technical efforts to record and connect dates and names in the past and to offer a kind of grammar of the graphics of historical representation.

Endnotes

¹ For interdisciplinary perspectives on graphic representation, epistemology, and aesthetics, see Edward Tufte, *The Visual Display of Quantitative Information* (Cheshire, CT: Graphics Press, 2001); idem., *Beautiful Evidence* (Cheshire, CT: Graphics Press, 2006); Michael Lynch and Steve Woolgar, ed., *Representation in Scientific Practice* (Cambridge, MA: MIT Press, 1990); Brian S. Baigrie, ed., *Picturing Knowledge: Historical and Philosophical Problems Concerning the Use of Art in Science* (Toronto: University of Toronto Press, 1996); James Elkins, *The Domain of Images* (Ithaca: Cornell University Press, 1999); Barbara Maria Stafford, *Artful Science: Enlightenment Entertainment and the Eclipse of Visual Education* (Cambridge, MA: MIT Press, 1994); Caroline A. Jones and Peter Galison, ed. *Picturing Science, Producing Art* (New York: Routledge, 1998); Lorraine Daston, *Things that Talk: Object Lessons from Art and Science* (New York: Zone Books, 2004). The classic works in the field are Étienne-Jules Marey, *La Méthode graphique dans les sciences expérimentales* (Paris: G. Masson, 1885) and H. Gray Funkhouser, “Historical Development of the Graphical Representation of Statistical Data,” *Osiris*, vol. 3. (1937): 269–404. The authors of this book are profoundly indebted to the excellent librarians of Princeton University, and in particular to Steven Ferguson whose active collecting in the area of graphic schemes provided us with untold riches. His own account of the collecting project can be found in Steven Ferguson, “System and Schema:

Tabulae of the Fifteenth to Eighteenth Centuries Recently Acquired by the Princeton University Library,” in *Princeton University Library Chronicle* 49:1 (Autumn 1987), 9–30.

² For time in cartography, see Walter A. Goffart, *Historical Atlases: The First Three Hundred Years, 1570-1870* (Chicago: University of Chicago Press, 2003); Jeremy Black, *Maps and History: Constructing Images of the Past* (New Haven: Yale University Press, 1997); Arthur Howard Robinson, *Early Thematic Mapping in the History of Cartography* (Chicago: University of Chicago Press, 1982); Alessandro Scafi, *Mapping Paradise: A History of Heaven on Earth* (Chicago: University of Chicago Press, 2006); J. B. Harley and David Woodward, *The History of Cartography* 3 vols. (Chicago: University of Chicago Press, 1987).

³ Eviatar Zerubavel, *Time Maps: Collective Memory and the Social Shape of the Past* (Chicago: University of Chicago Press, 2003).

⁴ George Lakoff and Mark Johnson, *Philosophy in the Flesh: The Embodied Mind and Its Challenge to Western Thought* (New York: Basic Books, 1999), 155.

⁵ W. J. T. Mitchell, “Spatial Form in Literature: Toward a General Theory,” in W. J. T. Mitchell, ed., *The Language of Images* (Chicago: University of Chicago Press, 1980), 274.

⁶ Mitchell, *Spatial Form in Literature*, 274.

⁷ Mary Bouquet, “Family Trees and their Affinities: The Visual Imperative of the Genealogical Diagram,” *Journal of the Royal Anthropological Institute* 2:1

(1996): 43–66; Robert J. O’Hara, “Trees of History in Systematics and Philology,” *Memorie della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale di Milano*, 27:1 (1996): 81–88; “Systematic Generalization, Historical Fate and the Species Problem,” *Systematic Biology*, 42:3 (1993): 231–46; Carlo Ginzburg, “Family Resemblances and Family Trees: Two Cognitive Metaphors,” *Critical Inquiry* 30:3 (Spring 2004): 537–54.

⁸ Anthony Grafton, *Joseph Scaliger: A Study in the History of Classical Scholarship* (Oxford: Clarendon, 1983).

⁹ For a modern example, see Harry Elmer Barnes, *A History of Historical Writing*, 2nd ed. (New York: Dover, 1963), cited also in Hayden White, “The Value of Narrativity in the Representation of Reality,” in *The Content of the Form: Narrative Discourse and Historical Representation* (Baltimore: John Hopkins University Press, 1987), 1–25.

¹⁰ White, “Value of Narrativity,” 4–5.

¹¹ White, “Value of Narrativity,” 8.

¹² Petrarch’s notes are reconstructed from surviving copies by Giuseppe Billanovich, *Un nuovo esempio delle scoperte e delle letture del Petrarca L’Eusebio-Girolamo-PseudoProspero*, *Schriften und Vorträge des Petrarca-Instituts Köln*, 3 (Krefeld: Scherpe, 1954).

¹³ Daniel Rosenberg, “Joseph Priestley and the Graphic Invention of Modern Time,” *Studies in Eighteenth-Century Culture* 36 (Spring 2007), 55–104.

¹⁴ Joseph Priestley, *Description of a New Chart of History* (1769), in *The Theological and Miscellaneous Works of Joseph Priestley*, ed. John Towill Rutt (London: G. Smallfield, 1817) 24:479–80.

¹⁵ Henri Bergson, *Matter and Memory*, trans. by N. M. Paul and W. S. Palmer (New York: Zone Books, 1988), 207.

¹⁶ Zerubavel, *Seven Day Circle: The History and Meaning of the Week* (New York: Free Press, 1985).