

Treating visuals as sites of power inscription, the authors advance a Foucauldian design model based on the Panopticon—Bentham's late-eighteenth-century architectural figure for empowerment based on bimodal surveillance. Numerous examples serve in demonstrating that maximum effectiveness results when visuals foster simultaneous viewing in the two panoptic modes, the synoptic and the analytic. The panoptic theory of visual design is shown to be compatible with many privilegings in the literature of visual design that have hitherto appeared ad hoc and undertheorized, with relations masked by the disparate terminologies employed. The limitations of panoptic theory are located in its neglect of oppositional practices—seen as the most compelling horizon for research on the empowerment of designer and viewer through visual design.

Modes of Power in Technical and Professional Visuals

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This article predicates that technical and professional visuals are not only instruments of communication or even of knowledge but also instruments of power. Thus it goes beyond the traditional notion of visuals as *mirror*—a particularly disabling metaphor—and even the notion of visuals as *text*—an increasingly fashionable metaphor in the current theoretical literature—to the more enabling notion of visuals as *site of power inscription*. Based on the taxonomy of power established by philosopher Michel Foucault (*Discipline*) and drawing on historical explanations of the power of visuals, the article examines the Panoptic technology of power—specifically its two major modes or strategies: the synoptic and the analytic.

THE PANOPTICON

But this is to get ahead of ourselves. We turn, then, to a description of the Panopticon, an architectural figure described in Jeremy Bentham's eponymic late-eighteenth-century text, which posits the

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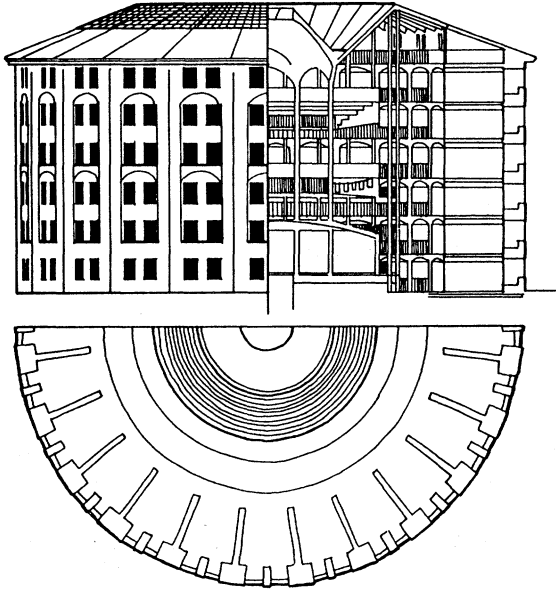


Figure 1. The Panopticon of Jeremy Bentham

SOURCE: *Rethinking Art History: Meditations on a Coy Science* (Preziosi). Used by permission of Yale University Press. Copyright © 1989 by Donald Preziosi.

Gaze as a new kind of disciplinary tactic (see Figure 1). In Bentham's conception, the Panopticon incorporates a tower central to an annular building that is divided into cells, each cell extending the entire thickness of the building to allow inner and outer windows. The occupants of the cells, be they madmen, patients, criminals, workers, or students, are thus backlit, isolated from one another by walls, and subject to scrutiny both collectively and individually by an observer in the tower who remains unseen. Toward this end, Bentham envisioned not only venetian blinds on the tower observation ports but also mazelike connections among tower rooms to avoid glints of light or noise that might betray the presence of an observer. In other words, the Gaze is unidirectional: The warden can see the inmate but not vice versa. Such asymmetry of seeing-without-being-seen is, in fact, the very essence of power for Foucault because, ultimately, the power to dominate rests on the *differential* possession of knowledge ("Subject" 223).

The association of power with the asymmetry of seeing-without-being-seen has not escaped notice in the literature of postmodern

theory. Consider, for example, Alain Robbe-Grillet's attack on Sartre for the regrettable anthropomorphism underlying the privileging of smell and tactility in *La Nausée*: Drowned in the *depth* of things, man ultimately no longer even perceives them: his role is soon limited to experiencing, in their name, totally *humanized* impressions and desires . . ." (68). Robbe-Grillet counters by privileging sight on the basis of its relative lack of appropriation of the Other:

The sense of sight immediately appears, in this perspective, as the privileged sense. . . . Optical description is, in effect, the kind which most readily establishes distances: the sense of sight, if it seeks to remain simply that, leaves things in their respective place. (73)

But, queries Fredric Jameson, "What if the pure look . . . were rather the vehicle for something like a *will* to power over the external world?" (172). In support, Jameson cites Sartre's denunciation of "the Look, and the position of the subject which it affords ('the right to look without being looked at'), as the very element of white supremacy and of the colonial situation" (173): "For three thousand years the white man has enjoyed the privilege of looking without being looked at; he was pure Look" (Sartre ix).¹

Bruno Latour would agree. More important, for our purposes, Latour extends Sartre's account of the politics of the Look to visual representations of the subject of the Look. Thus for Latour, anthropologist Fabian's distinction between us and "Savages" is one of asymmetric visual representation:

An asymmetry is created because we create a space and a time in which we place the other culture, but they do not do the same. For instance, we map their land, but they have no maps either of their land or of ours. ("Visualization" 16)

For Latour, like Foucault, such asymmetry is at the very heart of colonialist power.

Clearly, the power derived from the Foucauldian Gaze (or Sartrean Look) and the associated visual representations of the subjects of the Gaze is janiform; that is, it is both inclusionary and exclusionary, both empowering and disempowering. Equally clearly, much remains to be said about the mechanisms of viewing from the perspective of *both* the empowered and the disempowered. Following Foucault's obvious analytical predilection, however, we turn our attention to those who are empowered, more specifically, to the modes of viewing associated with empowerment. According to Foucault, the new visi-

bility or surveillance afforded by the Panopticon was of two types: the synoptic and the analytic. The Panopticon, in other words, was designed to ensure a "surveillance which would be both global and individualizing" (*Power/Knowledge* 148).

Synoptic surveillance is important because it empowers one to solve the chief problem of the penal culture, indeed the chief problem of the modern age, namely, "to procure for a small number, or even for a single individual, the instantaneous view of a great multitude" (Foucault, *Discipline* 216). The Panopticon, of course, offers an exemplary case of synoptic surveillance, with its distribution of an entire prison population within the purview of a single, unseen overseer located in a central tower. The Panopticon offers an equally exemplary case of analytic surveillance. Analytic surveillance became important when it was necessary to analyze, impose discipline, and correct behavior at the level of the *individual* inmate. Individuals had to be separated and compared both to each other and against a norm of acceptable behavior, and the Panopticon made it possible to discern similarities and differences among a constant class of people (prisoners) in an immediate, efficient, and rapid manner.

THE PANOPTIC MODALITY OF POWER AND TECHNICAL COMMUNICATION

But the inevitable question arises: Of what interest to technical communication specialists is an idealized model of penal supervision that, on one level, the Panopticon seems to represent? Foucault's answer is swift and sure:

The Panopticon is a generalizable model of functioning; a way of defining power relations in terms of the everyday life of men. . . . Represented as a pure architectural and optical system, it is in fact a figure of political technology that may and must be detached from any specific use. (*Discipline* 205)

An admirer of Foucault, Gilles Deleuze describes the wide applicability of the panoptic modality of power:

[The Panopticon] is defined as a *pure theme*, independent of the particular substances in which it enters (whether the substance be penal, medical, educational, occupational, military, etc.). What is this theme? It is whatever "human multiplicity" must be rendered enumerable and controllable. (1216, our translation)

Moreover, Deleuze's generalization of the panoptic model does not go far enough, for the "theme" of which he speaks need not be restricted to "human multiplicity"; surely the panoptic modality can be applied to "natural multiplicity" as well, thereby bringing the natural as well as the human sciences within its purview. Such an extension is, in fact, hardly radical, even for Foucault. Admittedly, Foucault's remarks are largely confined to the operation of power in the *human* sciences; indeed, he explicitly distinguishes between power over people and power over things ("Subject" 217-19). Certainly, too, the main target of his extended analyses is power over people. But the occasional example betrays, or at least hints at, an erosion of the a priori distinction between the social and the natural. Later commentators mount a frontal attack on the distinction and its associated methodology. Surveying recent developments in the field of the sociology of science, Trevor Pinch notes that theorists such as Bruno Latour have suggested the need for a new methodological principle: the "principle of super-symmetry whereby we treat natural actants (scallops, electrons and the like) in the same way that we treat human actors" (225). For the most resolute rejection of the distinction between the social and the natural, here is historian of science Joseph Rouse:

It is no longer possible . . . to sustain a political distinction between the exercise of power over human bodies and the development and use of capacities to control and manipulate things. Those who are attracted to Foucault's account of our social practices and institutions as traversed by capillary relations of force or domination will thus have to come to terms with the forms of power/knowledge that invest the natural sciences and our dealings with the physical/biological world. (244)

In what follows, we apply Foucault's taxonomy of the modes of panoptic surveillance—the synoptic and the analytic—to a variety of technical visuals. We begin with an analysis of the synoptic mode of power.

The Synoptic Mode of Power

For an appreciation of the synoptic power of pictorial representations, particularly in comparison to verbal representations, the *locus classicus* is Roland Barthes: "Pictures . . . are more imperative than writing, they impose meaning *at one stroke*, without analyzing or diluting it" (10, emphasis added), or some might add, "without obscuring it." Duncan Davies, Diana Bathurst, and Robin Bathurst provide a memorable illustration of Barthes's claim:

One of the key features of the relationship between pictures and words—the immediacy of the impact of the picture—was illustrated by the tragic events of the launch disaster of the *Challenger* shuttle on January 28, 1986. The NASA commentator, watching the precise outputs of key numbers and words on the screen, sounded puzzled, saying, “We have lost the downlink: we have a major malfunction,” while the millions of the watching public, on site or in front of television sets, had seen that the shuttle was already totally destroyed by fire and explosion. (69-71)

Nor do pictures provide the most compelling case of the synoptic power of visuals. For that, we turn to the map, which may, in fact, be considered as the paradigmatic case of the synoptic visual. In a map, after all, the whole world can be brought within the purview of a single viewer. In Louis Marin’s words, “The map as a representation is the simulacrum that permits me to appropriate in a single look the totality of the Earth” (50, our translation).

Appreciation of the synoptic mode of power in visuals is not new (Barton and Barton, “Trends” 95-96). It is, in fact, characteristic of—and, indeed, typically the only mode acknowledged in—earlier positivist views of the power of visuals. According to nineteenth-century French engineer Charles Joseph Minard, the principle that characterizes his graphs (*tableaux graphiques*) and quantitative maps (*cartes figuratives*) “is to have the proportions of the numerical results appreciated immediately by the eye, as much as possible” (2, original in italics, our translation, emphasis added). In fact, so strong was Minard’s espousal of synopticism in his *cartes figuratives* that he did not hesitate to sacrifice geographic fidelity to ocular manageability: In the following explanation accompanying a flow map portraying the movement of travelers on the principal railways of Europe in 1862, Minard rationalizes his abandonment of strict accuracy of the geographic base:

In order to position the flow lines without enlarging the map too much, which would hinder encompassing it at a glance, which is the advantage of *cartes figuratives*, I have had to alter the geographical proportions considerably and to omit Ireland and Scotland. (qtd. in Robinson 153)

William Playfair, generally credited with the invention of the bar graph in the nineteenth century, touts the synoptic power of this new visual genre in an unconventional place, the title of one of his charts: “Chart Shewing at One View the Price of the Quarter of Wheat & Wages of Labour by the week from the Year 1565 to 1821” (emphasis added; see Figure 2). Elsewhere, he elaborates:

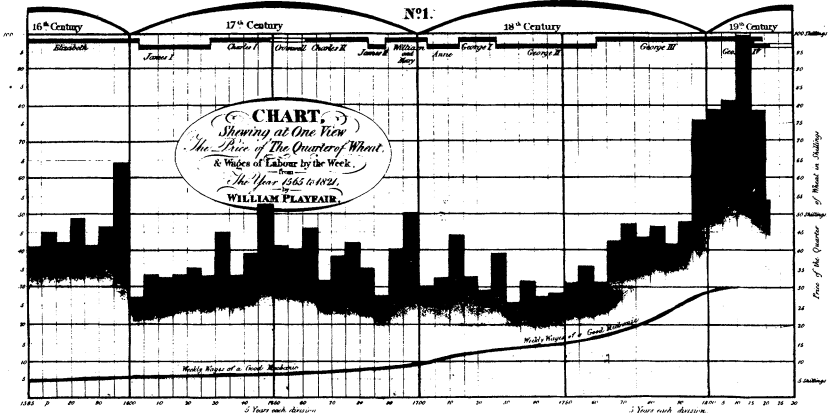


Figure 2. A Chart by William Playfair

SOURCE: *The Visual Display of Quantitative Information* (Tufté). Used by permission of Graphics Press.

On inspecting any one of these Charts attentively, a sufficient distinct impression will be made, to remain unimpaired for a time, and the idea which does remain will be simple and complete, at once including the duration and the amount. Men of great rank, or active business, can only pay attention to general outlines; nor is attention to particulars of use, any farther than as they give a general information; it is hoped, that with the assistance of these Charts, such information will be got, without the fatigue and trouble of studying the particulars of which it is composed. (xiv)

The Analytic Mode of Power

Note Playfair’s dismissive treatment of the “particulars” on which the synoptic image is based. But particulars are an equally important source of empowerment. Recall our earlier citation on the synoptic power of the pictorial representation of the *Challenger* disaster. Davies, Bathurst, and Bathurst contrast the *Challenger* case with that of the crippled *Apollo XIII* in the early 1970s:

For nursing the malfunctioning capsule back to an improvised earth re-entry, pictures were far less important than numbers. The data from the vehicle had to be processed furiously over hours and days by the

combined power of the ground computers, so as to work out and decide between the rescue options. (71)

Clearly, the empowering mode here is not the synoptic but the analytic. For another example of the power of the analytic mode, we turn to Foucault himself. In one of his rare examples dealing with technical visuals, Foucault shows his appreciation of the analytic power of the table:

The first of the great operations of disciplines is . . . the constitution of "*tableaux vivants*," which transform the confused, useless or dangerous multitudes into ordered multiplicities. The drawing up of "tables" was one of the great problems of the scientific, political and economic technology of the eighteenth century: how one was to arrange botanical and zoological gardens, and construct at the same time rational classifications of living beings. . . . In the eighteenth century, the table was both a technique of power and a procedure of knowledge. It was a question of organizing the multiple, of providing oneself with an instrument to cover it and to master it; it was a question of imposing upon it an "order." (*Discipline* 148)

Here the emphasis, as in disciplining social misfits, is on recalcitrant individuals—individuals that must be normalized without surrendering their integrity. In practice, the individuals vary; they may, for example, be organic or inorganic, qualitative or quantitative. In displays dealing with quantitative individuals—that is, with numbers—the few contemporary graphic designers appreciative of the analytic capacity of visuals have turned to a numbers game. Thus we are told that William Cleveland's offering of a multipanel graphic display of carbon dioxide concentration measurements for Mauna Loa, Hawaii, entitled "The Power of Graphical Display," shows 2,112 numbers (11). However, the winner of the numbers game is clearly Edward Tufte: "The most extensive data maps, such as the cancer atlas and the count of the galaxies, place *millions of bits* of information on a single page before our eyes" (*Visual Display* 26, emphasis added). Concludes Tufte: "No other method for the display of statistical information is so powerful" (26).

TANDEM OPERATION OF THE SYNOPTIC AND ANALYTIC MODES

Thus far we have considered the two panoptic modes separately, but maximal empowerment of the viewer frequently entails operation

in *both* the synoptic and the analytic modes. We turn, then, to an examination of visuals illustrating the efficacy of such tandem operation. For a first example, we consider the visual displays typically associated with industrial control rooms; in particular, we focus on the control displays for nuclear power plants. The analyses of researchers such as Larry Goodstein of the disastrous incident at the Three Mile Island (TMI) nuclear facility in 1979 can be viewed in Foucauldian terms as revealing an unfortunate reliance on a display system based exclusively on the analytic mode of surveillance. Presentation technique in the TMI control room was based on what Goodstein terms the "one measurement—one indication" approach, the technical version of the "one-idea-per-visual" design ideal privileged in many technical communication textbooks (Barton and Barton, "Simplicity" 14). As a result, the control room was filled with an overwhelming array—literally thousands—of individual displays, each registering one data value. During the incident, moreover, hundreds of alarms annunciated within the first few minutes of the crisis. Operators trying to diagnose the cause of the problem, Goodstein points out, had difficulties in "seeing the forest for the trees" (441). In remedy, Goodstein proposes the inclusion of integrated displays adding a synoptic dimension to the view of system performance. In the integrated display shown in Figure 3, for example, eight critical parameters reflecting safety-related aspects of total system state are selected for presentation. The magnitude of each parameter is plotted along an assigned polar axis. The transformations and scaling for each parameter are such that in normal operation the display is a regular octagon, a shape suggesting stability and normalcy, as in Chart A. Deviations from regularity in the display then signal abnormalities in system operation: The irregular polygon of Chart B might be observed during, say, a loss-of-coolant accident.

Our example drawn from the nuclear power plant control industry documents the relative impotence of viewers confined to visual representations embodying the *analytic* mode of power. For our second example, let us examine the reverse case, that is, a case of the relative impotence of viewers confined to the *synoptic* mode of power. Consider, then, the influential design of the critically acclaimed London Underground Diagram (LUD) shown in Figure 4. In the LUD, as in routing diagrams generally, viewers are interpellated not as concrete individuals with specific potential itineraries in mind but rather as contemplative observers, as *voyeurs*—the masters of possibilities—and although they might appear to be empowered through ascription

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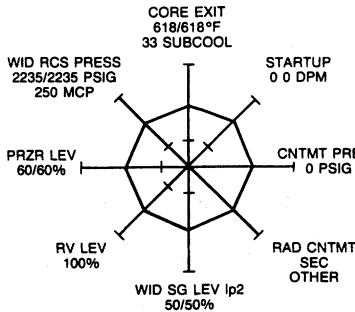


Chart A. Normal operation

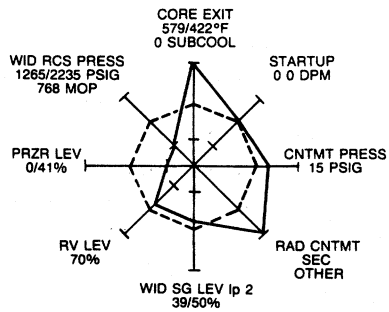


Chart B. Loss-of-coolant incident

Figure 3. Illustrative Integrated Displays: Polygon Charts

SOURCE: *Handbook of Human-Computer Interaction* (Helander). Used by permission of Elsevier Science Publishers.

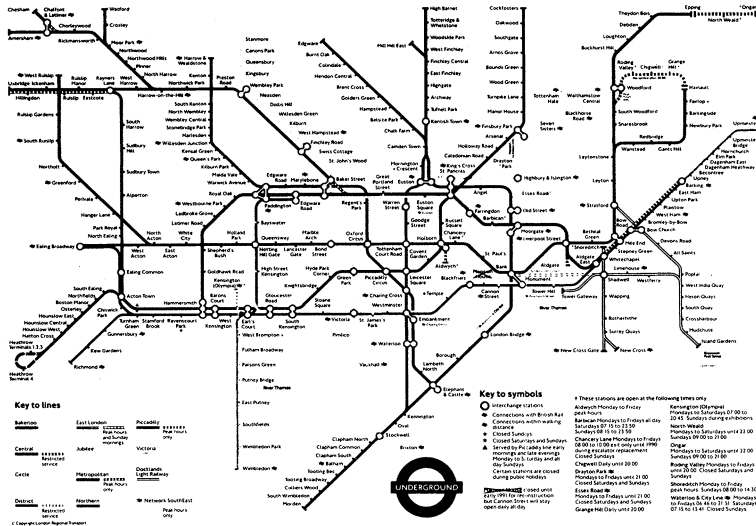


Figure 4. The London Underground Diagram (LUD)

SOURCE: LRT Registered User Number 92/E/552. Used by permission of London Transport Museum.

of such an Olympian perspective, the empowerment is illusory: As specific *voyageurs* with concrete travel needs, they are relatively unempowered (Barton and Barton, "Ideology" 52). The viewers' relative impotence becomes immediately obvious when one considers an alternative, more enabling representation—the electronic board maps in several Parisian Metro stations whereby viewers can override the totalizing effect of the map by registering their destinations and receiving individualized, highlighted itineraries (64).

Returning across the Channel to our LUD example, Michael Burke and Ian McLaren note that the London Transport has also recently introduced electronic displays at certain mainline railstations. Each display presents

a menu of approximately three hundred routes to be taken from that point. The dialogue with the system is in three languages simultaneously (English, French, and German). The selected route is presented in isolation from the total network; points where the passenger is obliged to change trains are stated clearly. (109)

Nor is the transition from the *voyeuristic* to the *voyagistic* complete: As the authors note, "theoretically the [electronic display] system could be extended by being distributed to domestic television sets by means of a viewdata or teletext system" (109).

The power of the tandem operation of synoptic/analytic modes is also revealed by JoAnne Yates's analysis of the Chart Room that was at the hub of Du Pont's affairs in the 1920s. The Chart Room, designed for use by the firm's Executive Committee, was developed to facilitate "Du Pont's transition from a functionally departmentalized firm to a multi-divisional, product-based firm" (29). Dominated by an array of 350 charts, the Chart Room was, in fact, a Panopticon whose "occupants" were graphs and whose "overseer" was the Executive Committee. The chart system, featuring return-on-investment (ROI) charts, was used synoptically as a visual summary of corporate affairs; the individual charts, devoted to individual corporate divisions, served analytically for closer study, review, and attention as deemed desirable or necessary. Others have noted the empowerment derived from the spatial collocation of families of visuals: Here, for example, is Latour's eloquent description of, in effect, the rise of cartographic Panopticons in nineteenth-century Europe:

Instead of being dominated by the natives and by nature, like the unfortunate [French explorer] Lapérouse staking his life every day, the cartographers in Europe start gathering in their chart rooms . . . the

	Adult Mean IQ	Child Mean IQ
Higher Professional	139.7	120.8
Lower Professional	130.6	114.7
Clerical	115.9	107.8
Skilled	108.2	104.6
Semiskilled	97.8	98.9
Unskilled	84.9	92.6

Figure 5. Table of IQ Data Amassed by Sir Cyril Burt

SOURCE: *The Elements of Graphing Data* (Cleveland). Copyright © 1985 Bell Telephone Laboratories, Inc., Murray Hill, NJ. Reprinted by permission of Wadsworth & Brooks/Cole Advanced Books & Software, Pacific Grove, CA 93950.

bearings of all lands. . . . How large has the earth become in their chart rooms? No bigger than an *atlas* the plates of which may be flattened, combined, reshuffled, superimposed, redrawn at will. What is the consequence of this change of scale? The cartographer *dominates* the world that dominated Lapérouse. (*Science in Action* 224)

But the power of tandem operation of the panoptic modes is seldom so pivotal as in our next example taken from Cleveland, where the relation between the analytic and the synoptic is the central issue (94-97) (see Figure 5). The table shows the putative results of a study by geneticist Sir Cyril Burt of the relation between the IQs of fathers and those of their offspring across six social classes. The tabulated experimental, or analytic, data seem innocent enough; after all, one intuitively expects a positive correlation between the two sets of IQs. However, when plotted as in Figure 6, the analytic data points are seen to lie extraordinarily close to the synoptic curve, a *theoretical* curve showing a linear relation between the two sets of IQs (including even a factor of one-half, to account for the effect of the individual parent). It is only when the two modes are juxtaposed that the relation between the synoptic (theoretic) and the analytic (empiric), between ideal and practice, may readily be perceived as too perfect. The judgment of Burt's peers: The data had been faked (Kamin; Paul, "Nine Lives," "Textbook Treatments").

RELATED FORMULATIONS IN THE LITERATURE

Foucault's tandem modes of surveillance provide a compelling theoretical warrant for various privilegings, or valorizations, in the visual-design literature—privilegings that hitherto appear scattered,

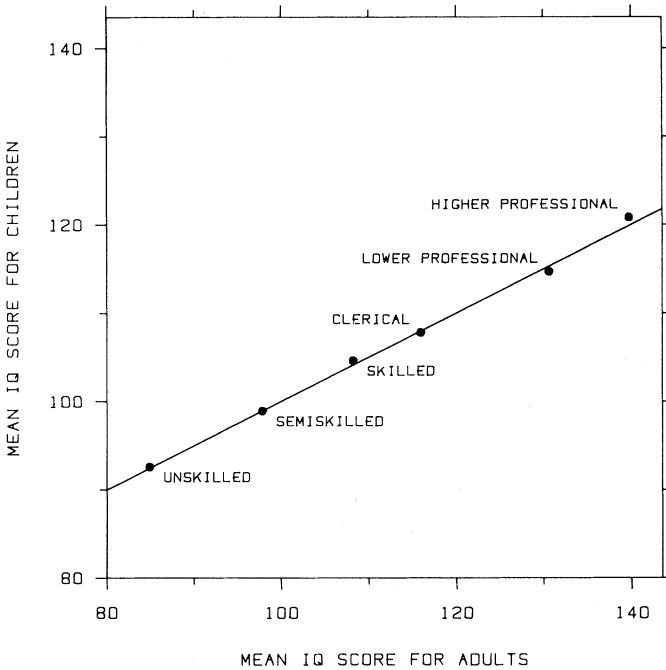


Figure 6. Burt's Data (Analytic) Compared with the Synoptic Ideal

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ad hoc, undertheorized, and whose relations to each other are masked by the disparate terminologies employed.² As a first example of the compatibility of panoptic theory with various privilegings in the visual-design literature, consider the work of Jacques Bertin. In *Graphics and Graphic Information-Processing*, Bertin contrasts two kinds of demographic maps, "seeing maps" and "reading maps"—and privileges the former (147; see also *Semiology* 34-35). Seeing maps represent demographic data with a graded set of concrete signs, that is, signs having visual properties—above all, area, in practice—homologous with, or mimetic of, their referents. Thus, on the seeing map of Figure 7, the areas of the circles show a direct relation with land values in the corresponding subregions of eastern France. The relative concentration of larger circles near the left edge of the map permits us to

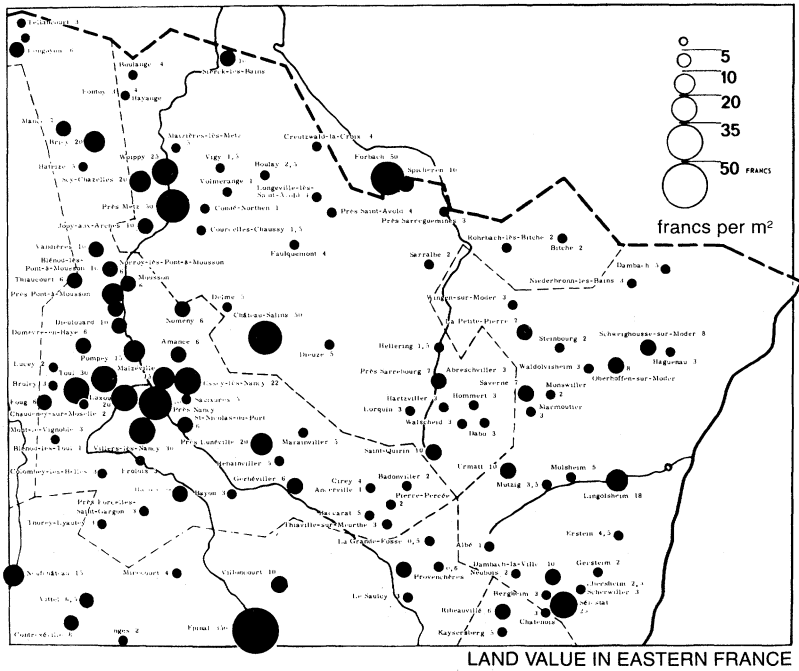
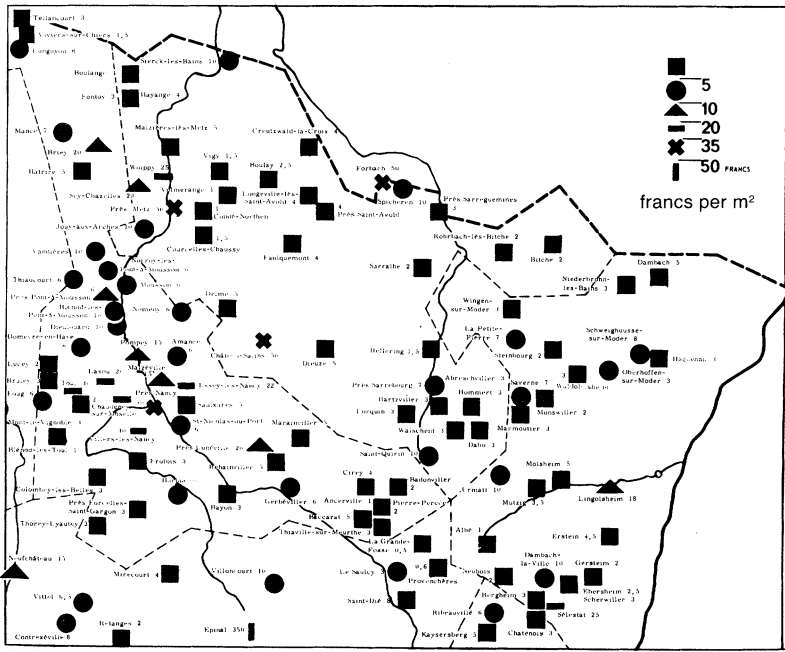


Figure 7. "Seeing" Map by Jacques Bertin

SOURCE: *Semiology of Graphics: Diagrams, Networks, Maps* (Bertin). Reprinted by permission of University of Wisconsin Press.

see at a glance, for example, that land values in eastern France in the 1950s were highest in what turns out to be the valley of the Moselle River. At the same time one can, of course, make very localized observations; for example, land around Vittel (lower-left corner) costs about 5 francs per square meter. As Bertin (*Graphics*) notes, seeing maps serve viewers well both for ready perception of general tendencies among data and as a decipherable, detailed record of the data. In our terms, seeing maps are well adapted for either synoptic or analytic apprehension. In contrast, the reading map of Figure 8 represents the same data with a set of heterologous abstract symbols whose visual properties—in this case, areas—are *not* mimetic of their referents—that is, land values. (In fact, the areas of the abstract symbols used on the given reading map tend to show an *inverse* relation with land value, so that a *high* cost for Moselle River valley property may



LAND VALUE IN EASTERN FRANCE, from the weekly magazine, "Elle." Paris, 1959.

Figure 8. "Reading" Map by Jacques Bertin

SOURCE: *Semiology of Graphics: Diagrams, Networks, Maps* (Bertin). Reprinted by permission of University of Wisconsin Press.

actually be seen as a concentration there of low-area symbols.) As with seeing maps, the detailed recording of demographic data on reading maps can be deciphered for analytical purposes; in contrast to the marks on seeing maps, however, those on reading maps generally lack the Gestalt properties needed to foster holistic perception. In Foucauldian terms, seeing maps enable panoptic surveillance, that is, surveillance on *both* the synoptic and the analytic levels; reading maps, on the other hand, permit only analytic surveillance.³

As a second example of the compatibility of panoptic theory with various privilegings in the graphic-design literature, we turn to the work of Edward Tufte. In effect, Tufte criticizes the traditional visual design approach—an approach that, as we noted earlier, emphasizes synoptic features; he advocates, rather, "micro/macro" design

approaches—approaches that “enforce both local and global comparisons and, at the same time, avoid the disruption of context switching” (*Envisioning* 50). We recognize a close parallel between Tufte’s “micro reading” and our analytical mode, as well as between Tufte’s “macro reading” and our synoptic mode, of viewing. Tufte’s design predilections stem from a general criticism of “low information” graphics (*Visual Display* 168); his general sense that the analytic level has been undervalued in graphic design becomes acute in *Envisioning Information*, where he endorses Mies Van Der Rohe’s dictum that “God is in the details”—a dictum “capturing the essential quality of micro/macro performances” (51). This siting of God in the analytic (“in the details”) is additional to God’s earlier siting in the synoptic as a detached, Olympian observer, the master of possibilities. More important here, with the inclusion of the analytic, the viewer, too, is seen as additionally empowered:

High-density designs also allow *viewers* to select, to narrate, to recast and personalize data for their own uses. Thus control of information is given over to viewers, not to editors, designers, or decorators. Data-thin, forgetful displays move viewers toward ignorance and passivity. . . . (*Envisioning* 50)

In the pursuit of micro/macro qualities, Tufte advocates a “most unconventional design strategy . . . to clarify, add detail” and illustrates with a fragment of a precise axonometric projection of downtown Manhattan on which Constantine Anderson worked for 20 years (*Envisioning* 37) (see Figure 9). In Anderson’s masterpiece, the “fine structure of exquisite detail leads to personal microreadings, individual stories about the data,” while the “detail cumulates into larger coherent structures; those thousands of tiny windows, when seen at a distance, gray into surfaces to form a whole building” (37). In other words, the “fine structure” of such graphics permits an analytical mode based on close examination of details, whereas the cumulative effects of such details provide a synoptic view. For Tufte, Anderson’s visual exemplifies the empowerment of viewers through micro/macro, or panoptic, designs:

At work here is a critical and effective principle of information design. Panorama, vista, and prospect [macro information] deliver to viewers the freedom of choice that derives from an overview, a capacity to compare and sort through detail. And that microinformation, like smaller texture in landscape perception, provides a credible refuge where the pace of visualization is condensed, slowed, and personalized. (*Envisioning* 38)

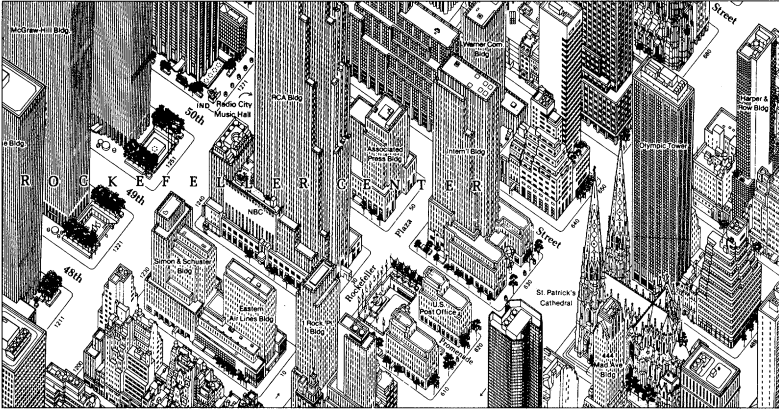


Figure 9. Fragment of Constantine Anderson's Axonometric Projection of Downtown Manhattan

SOURCE: *Envisioning Information* (Tufte). Photograph by Graphics Press. Reprinted from *The Isometric Map of Midtown Manhattan*, copyright © 1882, by permission of The Manhattan Map Company, Inc. All rights reserved.

Moreover, as Tufte notes, “the power of micro/macro designs holds for every type of data display as well as for topographic views and landscape panorama” (*Envisioning* 38). And indeed, Tufte offers numerous examples of outstanding micro/macro designs for graphics other than topographical maps. For example, the available data on the temperature dependence of the electrical resistivity of copper—the results of hundreds of research studies conducted all across the globe over decades—are displayed both individually and collectively in a single graphic manifesting both enormous complexity and exquisite clarity.

Tufte's espousal of micro/macro, or panoptic, designs underlies a variety of privilegings in his works. It underlies, for example, his advocacy of mixing visual genres to assure the simultaneous presence of the synoptic and the analytic. Thus he suggests incorporating tables—primarily analytic/micro forms—within the graphic field when the graphic figure itself is predominantly synoptic/macro. The espousal of micro/macro design also underlies Tufte's privileging of certain genres of visuals. For despite his claim that “the power of micro/macro designs holds for every type of data display,” the micro/macro

principle is clearly more felicitous in some genres than in others. Not surprisingly, Tufte singles out for praise those genres most conducive to tandem operation of the synoptic and analytic modes. Thus quantitative maps, in particular, earn high praise: "Standards of excellence for information design are set by *high quality maps*, with diverse bountiful detail, several layers of close reading combined with an overview, and rigorous data from engineering surveys" (*Envisioning* 35). Also meritorious are "small multiples," which Tufte places at the "heart of visual reasoning": "Their multiplied smallness enforces local comparisons within our eyespan, relying on an active eye to select and make contrasts rather than on bygone memories of images scattered over pages and pages" (33).

If espousal of micro/macro design leads, as we have shown, to the valorization of certain genres, it leads concomitantly to the *devalorization* of others along with their associated techniques of visual representation. Thus Tufte inveighs against such traditional genres as the "dumb pie chart" (*Visual Display* 178) and the bar chart with its "information-empty bars" (*Envisioning* 46). In fact, let us consider in some detail the case of the bar chart, for the desire to augment the synoptic potential of the traditional bar chart by replacing its information-empty bars underlies the design innovations of many information designers. John Tukey, for instance, approaches redesign of a bar-chart variant termed the *frequency distribution chart* with the following rationale: "Tallying values into frequency distributions is wasteful. If we are to make a mark, it may as well be a meaningful one. The simplest—and most useful—meaningful mark is a digit" (296). On this basis, Tukey proposes replacing the "information-empty bars" with meaning-bearing elements; specifically, he fills the virtual space of the bars with abstract digits of the data (i.e., numerical values) in his graphic invention, the *stem-and-leaf plot* (see Figure 10). In Figure 10, in particular, the two leading digits (15) of the data values 156, 157, and 156 are relegated to the stem, and their final digits (6, 7, 6) serve as leaves; the latter digits occupy the space traditionally used for a bar. Nor is Tukey's design solution unique. Otto Neurath, too, would fill the virtual space of the "information-empty bar" with meaning-bearing elements; however, he chooses to fill it not with numbers but with concrete countable elements mimetic of their referents, thereby inventing a new visual genre—the *pictograph* (96-97) (see Figure 11).

Consider, finally, Cleveland's invention and associated rationale, the "*dot chart*, a graphical method . . . invented . . . in response to the

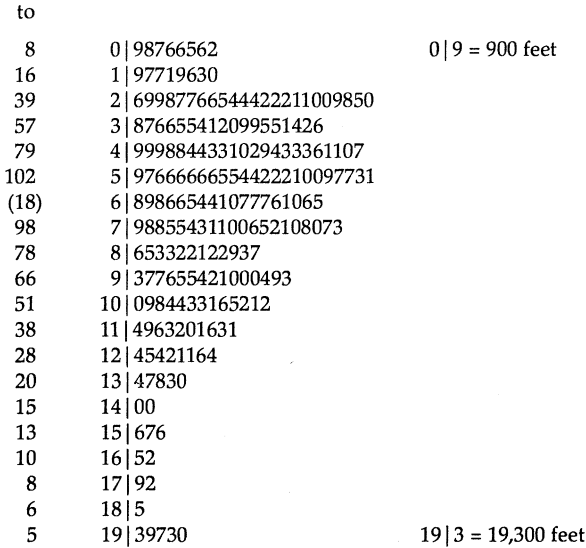


Figure 10. Illustrative "Stem-and-Leaf Plot" by John Tukey
 SOURCE: John Tukey, "Some Graphic and Semigraphic Displays," *Statistical Papers in Honor of George W. Snedecor* (Bancroft). Reprinted by permission of Iowa State University Press.

standard ways of displaying labeled data-bar charts, divided bar charts, and pie charts—which usually convey quantitative information less well to the viewer than dot charts" (144) (see Figure 12). Cleveland elects to replace the bar with a line of dim (leading) dots culminating in a data point. His attempt to minimize the "information-empty bar" by reducing its two dimensions to one is laudable; he fails, however, to note the analytic potential possible if the dots are regarded as countable. Note the power of the panoptic model as a heuristic tool for assessing such visual designs.

A CONCLUSION AND A BEGINNING

To this point, we have suggested the relevance of the panoptic modality of power to the design of technical visuals, its pervasiveness as a modern design principle, and its value as a heuristic tool for both generating and assessing new visual designs. But this is to tell only half the story. For as Foucault himself ventures: "Where there is

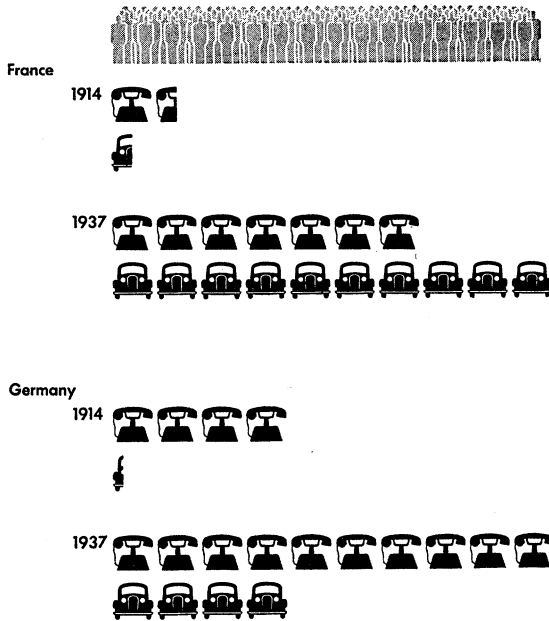
Telephones and Automobiles per 200 Population


Figure 11. Illustrative "Pictograph" by Otto Neurath

SOURCE: *Modern Man in the Making* (Neurath). Copyright © 1939 by Alfred A. Knopf, Inc. and renewed 1967 by Otto Neurath. Reprinted by permission of Alfred A. Knopf, Inc.

power, there is resistance, and yet, or rather consequently, this resistance is never in a position of exteriority in relation to power" (*History of Sexuality* 95). Foucault thus insists on the "strictly relational character of power relationships . . . whose existence depends on a multiplicity of points of resistance . . . present everywhere in the power network" (95). And elsewhere we hear provocative mention of "revolts against the gaze," of "resistances to the Panopticon" (*Power/Knowledge* 162, 163). This is heady stuff. But unfortunately, as Said notes, Foucault is unwilling to take seriously his own ideas about resistance to power (246). Said's critique on this point is worth citing in full:

Let us suppose that prisons, schools, armies, and factories were, as [Foucault] says, disciplinary factories in nineteenth-century France (since he talks almost exclusively about France), and that panoptic rule dominated them all. What resistances were there to the disciplinary

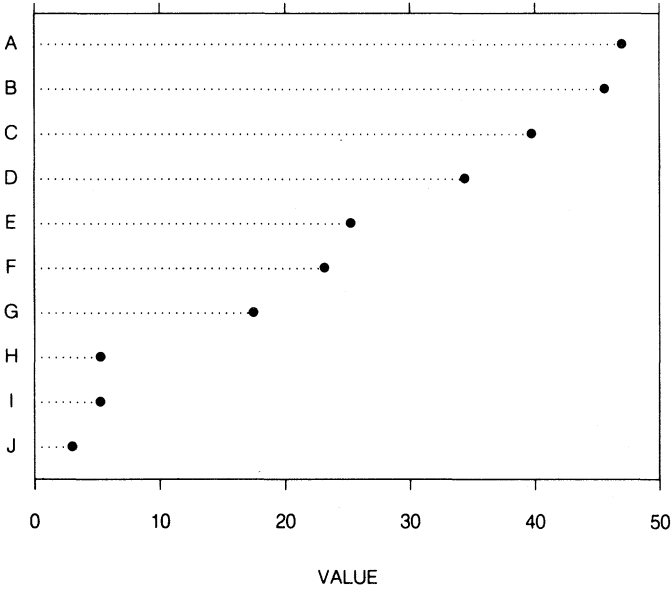


Figure 12. Illustrative "Dot Chart" by William Cleveland
SOURCE: *The Elements of Graphing Data* (Cleveland). Copyright © 1985 Bell Telephone Laboratories, Inc., Murray Hill, NJ. Reprinted by permission of Wadsworth & Brooks/Cole Advanced Books & Software, Pacific Grove, CA 93950.

order and why . . . does Foucault never discuss the resistances that always end up dominated by the system he describes? The facts are more complicated of course, as any good historian of the rise of the modern state can demonstrate. (245; see also the critique by Poulantzas 146-53)

Although an examination of resistances to the "disciplinary order" epitomized by the Panopticon is beyond the scope of this article, we will nevertheless indicate the direction that such a treatment might take. For guidance, we must leave the work of Foucault and turn to the complementary project of culture critic Michel de Certeau. De Certeau's project is the opposite of Foucault's:

. . . not to make clearer how the violence of order is transmuted into a disciplinary technology, but rather to bring to light the clandestine forms taken by the dispersed, tactical, and makeshift creativity of

groups or individuals already caught in the nets of "discipline." Pushed to their ideal limits, these procedures and ruses of consumers compose the network of an antidiscipline. (*Practice* xiv-xv)

De Certeau terms the project envisioned therein *heterology*, the science not of the Foucauldian "disciplinary order" but of the "Other." The heterological project is appropriate in de Certeau's eyes because of Foucault's undue privileging of one particular technological procedure in the organization of society—the panoptical. Yet "there are many other procedures besides panoptical ones . . . procedures that have remained unprivileged by history yet which continue to flourish in the interstices of the institutional technologies" (*Heterologies* 188-89). Such procedures are ubiquitous; collectively they constitute a polytheistic politics of oppositionality to "the 'monotheism' of the dominant panoptical procedures" (188).

Participation in the heterological project through the study of such oppositional procedures in the production and reception of visuals: This constitutes, in our view, the most compelling research horizon for students of the issue of power and technical and professional visuals.

NOTES

1. Note in this connection the burgeoning feminist criticism on the "masculine gaze" in the film theory and art historical literatures (Tickner, 113-15). John Berger's *Ways of Seeing* and Laura Mulvey's influential article "Visual Pleasure and Narrative Cinema" provide a good starting point. For a sampling of the ensuing debate on the masculine gaze—or, in its more general formulation, "gendered spectatorship"—see Mulvey, "Afterthoughts"; Mary Ann Doane; E. Ann Kaplan. In *The Power of the Image*, Annette Kuhn points out the connection between the male gaze and control: "To possess the image of a woman's sexuality is, however mass-produced the image, also in some way to possess, to maintain a degree of control over, woman in general" (11).

2. The preceding analyses are meant to be not exhaustive, but merely exemplary, of the wide applicability of the Foucauldian model of panoptic power to visual design. Nor do we mean to suggest that the concepts compared are automatically or perfectly equivalent either to Foucault's notion or to each other. To do so would be to blissfully invite the perils associated with what Edward Said has termed "traveling theory," namely, the inevitable drifting that occurs when theories are removed from their original contexts (226). They do, however, share a common terrain worthy of mapping.

3. We say *permit* rather than *enable* because the analytic potential of the reading map is comparatively limited. Bertin's assessment is even more severe: "A 'reading' map is not only a waste of time; it is a waste of information, and in fact is usually not even read" (*Graphics* 147).

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