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The City Is a Medium

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# The City Is a Medium<sup>1</sup>

Friedrich A. Kittler

Just as we are accustomed—when not also subjected—to absorbing energy in different forms at home, we will also find it quite easy there to receive or absorb accelerated changes and oscillations which our sensory organs pick up and integrate to form all that we know. I don't know whether philosophers have ever dreamed of a society for the domestic distribution of sensory reality.

Paul Valéry<sup>2</sup>

**C**APITAL.<sup>3</sup> The name already says it: Capitals are named after the human body. The state (since the Greeks) has been conceived of as an organism, whose head is its capital. This capital, in turn, is ruled by a chief, whose name once more means just that, the head.

Historically, the analogy can be shown to have been true. The prehistoric implosion of villages or entire countrysides and the subsequent emergence of the city was due, as Mumford illustrates, less to economic necessity than to the arms monopoly of a warlord. Plato, as lawmaker for an ideal city, proposed that its size be limited to the range of a voice, which would broadcast laws or commands.

And for centuries—from the prehistoric formation of cities, which was also the beginning of high culture or history, through the residential seats of baroque power—the military head remained architectonically visible: as fortress or acropolis, citadel or palace. Not until the first industrial revolution did a growth begin, whose spread, in Mumford's eyes, changed the face of the city and went, in the name of pure technology, beyond the ecological necessity of living together: megalopolis.

The description, however, of a digression is often itself a digression. When we cling to the clear-cut centrality of the head in thinking the concept "capital," it may be (as in Foucault's thesis "in political thought and analysis") that "we still have not cut off the head of the king."<sup>4</sup> The monarchs, to whom Europe owes most of its capitals, might thereby be said to have transcended architecture and achieved immortality in the head of theory itself. But if 'man' with his ecological necessity is only a

miniature of these potentates, it then becomes possible to decipher “head” and “capital” from technology rather than vice versa.

**TECHNOLOGY.** What strikes the eye of the passerby as a growth or entropy is technology, that is, information. Since cities no longer lie within the panopticon of the cathedral or castle and can no longer be enclosed by walls or fortifications, a network made up of intersecting networks dissects and connects the city—in particular its fringes, peripheries, and tangents. Regardless of whether these networks transmit information (telephone, radio, television) or energy (water supply, electricity, highway), they all represent forms of information. (If only because every modern energy flow requires a parallel control network.) Even in those unthinkable times when energy still needed beasts of burden like Sinbad and information required messengers like the first marathon runner, networks existed. They just hadn’t been built yet or, in technician’s jargon, implemented. The narrow, rugged mule trail was replaced by the railway and the highway, which in turn have been replaced by no less transient copper and fiber optic cables.

**NETWORKS.** It is common in the open spaces of the city to see the skeletal infrastructure on the backside of a building—these are networks, too.

To best reconstruct the way out of a labyrinth (as the Greeks were said to have done in reading the ruined foundations of Knossos, Phaistos, or Gournia), one doesn’t need to sketch the still visible connecting walls, rather their inverse: the invisible passages between path and door. Thus (in mathematical terminology) a “tree” takes shape, whose bifurcations distinguish the dead ends from the exits.

Or one can, like Claude Shannon, head mathematician for Bell Telephone laboratories, construct a mechanical mouse, capable of nosing its way through the labyrinth on the basis of trial and error. Whereas the mouse would be able to optimize city plans without Ariadne’s thread, Shannon himself was able to optimize an invisible something else: the telephone network in America.

**GRAPHS.** Mathematics first began around 1770 to take networks, such as the ones above, into account. Topology and graph theory not only reflect modernity, they are, in fact, its beginnings.

In the city still known at that time as Königsberg, seven bridges crossed the Pregel. A city is not only “the corollary of a street,”<sup>5</sup> rather by virtue of its network of rivers, canals, and news channels, a city is “the point at which all these paths meet.”<sup>6</sup> Leonhard Euler, newly appointed from medieval Basel as mathematician to the new capital St. Petersburg,

was moved to question whether or not it would be possible to cross all seven of these bridges over the Pregel once and only once on the same round-trip.<sup>7</sup> Euler's proof that it could never be done disregards all topographic data such as the layout of streets, their twists and turns, and their blind alleys. Euler could just as well have drawn the city plan of Königsberg on a rubber mat, since graph theory consists of just two abstract elements: coordinate points and their connecting lines. From these two abstract elements, all structures in space can be reconstructed: trees and stars, junctions and bridges, rings and hubs, regions and countries—and maps.

Place de l'Etoile, Ringstraße, and Anulare: these graphs have imprinted themselves upon our imagination. Nonetheless, city road maps don't describe streets and railway lines any more concretely than that rubber mat geometry. "The space in which the modern city unfolds its structures is clearly an abstract space in which the individual constraints are of a topological order; seen from the point of view of the unfolding of these structures, the territory is simply the surface effect of its own topicality."<sup>8</sup>

What returns in the form of the topographic passion of the nineteenth century, that is, of the generals, resembles in and of itself the oldest maps: On the *Tabula Peutingeriana*, which maps out early St. Pölten<sup>9</sup> as a relay station within the Roman postal system, the north-south boundaries (probably to better transport the medium "map" across country) have become so frayed that land, sea, and mountain formations are barely discernible. An empire, the Roman empire, vanishing into a pure media landscape.

INTERSECTIONS. Roads between cities are, nevertheless, the single connection which the *Peutingeriana* maps out. The Roman postal system ignored other arteries of life, such as aqueducts and, as Hölderlin wrote, the "shadowless streets" of the sea. Border towns were coordinate points along a line, relay stations created the tangents, while Rome, where all roads proverbially met, formed the axis of an entire system of intersections. Because no other system intersected or crossed the road system, one level sufficed to represent the graph. The proliferation, thanks to technology, of pure media channels renders that impossible. In a well-known textbook example, three houses need to be hooked up to three different energy systems—gas, water, and electricity—without one connection crossing the other. But this GWE-graph is not a flat graph, that is, the various connections cannot be flattened. A city, likewise, is not a flattenable graph. In a city, networks overlap upon other networks. Every traffic light, every subway transfer, and every post office, as well as all the bars and bordellos, speak for this fact. Bridges, of course, span other

rivers besides the Pregel and railway viaducts don't just cross the Traisen.<sup>10</sup> Modern city planners doubtlessly have tried to model the networks in Chandigarh, Brasília, and other new cities using a tree-graph whose branches and stems do not intersect and can thus be conflated. However, "a city is not a tree," rather a "half-grid" whose overlappings themselves belong to the system.<sup>11</sup>

CAPITALS expand upon this rule exponentially. It is not alone the state with its limes or system of borders, its self-induced "resonance" (*MP* 540), which defines the city. Rather in capitals, networks between cities overlap upon other networks between other cities. Beneath, upon, and above the ground, the overloaded nodes make a mockery of every conflation. Time in the city is a function of transfers, turn-ons and turn-offs. Jacques Offenbach's "Paris Life" (1866) is the first play to be set in a train station. In Vienna, imperial Austria connected the intersection of its four European railways and their terminals with an internal rail ring, which at the time was connected to the outlying regions by a light railroad. The sheer frequency of actual intersections in the capitals and metropolises is Tyche, that is, Fortuna or Chance, whom Valéry envisioned upon first awakening in Paris to the endless rush of traffic and then went on to celebrate as the prerequisite for all fortuitous conjunctions. Forgetting for a moment the rolled head of the king—the capital is clearly the "daughter of great numbers."<sup>12</sup>

MEDIA exist to process, record, and transmit numbers. A Greek city, probably Milet, provides us with two of our oldest forms of media: the coin and the vowel alphabet.<sup>13</sup> Rome, in order to extend itself from a city into a state, adopted the most advanced form of oriental transmission media: the Achaemenidian postal system.<sup>14</sup>

Thus our terms for media, if not directly, like "heart" or "brain of a circuit," derived from the human body, stem nonetheless from the city. From the day Shannon applied George Booles's circuit algebra to a coupling of telegraph relays, the elements which are logically the most simple, and which have no memory, have been known as gates or ports. Circuits, on the other hand, whose initial and final positions are not only a function of the gates and ports, but also of the circuit's own prehistory, presuppose (no less municipal here) a built-in memory. When the World War II mathematician John von Neumann laid down the principles for sequential working-off or computation for almost all present-day computer "architectures," he bestowed the fitting name "bus" on the parallel channels between hard drive, gate, and memory, and thus extended the Biedermeier tradition of metropolitan traffic. Von Neumann's prophesy that only computers themselves would be capable

of planning their own, more intelligent, next generation, because the complex knot of networks would surpass the planning ability of the engineers, has been fulfilled by computer programs called "routing": network models, like Shannon's mouse, which operate as if they were street plans (with all the aggravations of jaywalking and traffic jams). Entire cities made of silicon, silicon oxide, and gold wire have since arisen. Yet the living units or houses in these cities must be measured in terms of molecules whose total surface area, even after having been reproduced millions of times, barely fill a square millimeter. The technologic media miniaturize the city, while magnifying the entropy of megalopolis. Not only have the technological traffic modules of modernity, such as parking garages and airports, rendered obsolescent the age-old module "life-sized," indeed, it seems to me that modulization itself has been rendered obsolescent. And graph theory is responsible. The more one thinks about a capital like Paris, wrote Valéry, the more one learns about oneself from the city. No system, however, is self-governing, neither the city nor the module. It is hence more urgent, in a grey field without reference points, to connect up networks without value systems, and to take leave of

#### MUMFORD'S POINT OF DEPARTURE.

Through its concentration of physical and cultural power, the city heightened the tempo of human intercourse and translated its products into forms that could be stored and reproduced. Through its monuments, written records, and orderly habits of association, the city enlarged the scope of all human activities, extending them backwards and forwards in time. By means of its storage facilities (buildings, vaults, archives, monuments, tablets, books), the city became capable of transmitting a complex culture from generation to generation, for it marshalled together not only the physical means but the human agents needed to pass on and enlarge this heritage. That remains the greatest of the city's gifts. As compared with the complex human order of the city, our present ingenious electronic mechanisms for storing and transmitting information are crude and limited.<sup>15</sup>

Based on these remarks, Mumford clearly understands cities to be analogous to and compatible with computers—and therefore media. The analogy and its specific points only deal, however, with the two functions of the recording and the transmission of information, and it succumbs moreover to diachrony in its crossing of networks. The fundamental third function, information processing, is absent (because it would pull the carpet out from under Mumford's humanistic value judgments). It is almost as if the historian of cities had forgotten his insight that part of the greatness of ancient Florence consisted in having

erected with the Uffizi, the first office building—a central bureau for data processing.

**MEDIA** record, transmit and process information—this is the most elementary definition of media. Media can include old-fashioned things like books, familiar things like the city and newer inventions like the computer. It was von Neumann's computer architecture that technically implemented this definition for the first time in history (or as its end). A microprocessor contains a processor, the memory and buses, not just in addition to something else, but exclusively. The processor carries out logical or arithmetical commands, according to the parameters set up in the memory; the buses transmit commands, addresses, and data based on the parameters of the processor and its most recent command; the memory ultimately makes it possible to read commands or data at precise addresses or to encode them. This network of processing, transmission, and recording, or restated: of commands, addresses, and data, can calculate everything (based on Turing's famous proof from 1936) that is calculable.<sup>16</sup> The development of technologic media—from digital transmission media, like the telegraph, to analog recording media, like gramophone and film, and to the media for their transmission, radio and television—comes logically full circle.<sup>17</sup> Other media can, likewise, be transferred to the discrete universal machine. And this is reason enough to bring together the workings of the city with concepts from general information science. Reason enough, moreover, to decipher past media and the historical function of what we refer to as "man," as the play between commands, addresses, and data.

**DATA** can consist of random variables, so long as these variables have a predetermined format (analog or digital, bytes or words, and so forth). Von Neumann machines can assign strings standing for numbers and strings standing for letters to one and the same address. Thus an imperial edict for reform, dating from January 12, 1782, permitted, in the city of St. Pölten, "the charter of the Carmelite cloister (with 19 nuns), devoted solely to the life of introspection, to be revoked, the spaces to be converted into the boys' schoolhouse of the Regiment Pelegrini and to be used as a garrison, the ornaments and ritual objects of the chapel to be either confiscated, sold or given away and to establish the chapel itself as the magazine."<sup>18</sup> A unit of memory once set up for eternity became a memory unit with unrestricted access, serving henceforth the disciplined mobilization of troops and pupils. In the computer system, a read-write capable school boy obviously corresponds to read-write memory (random access memory) for variable data; in contrast, the ritual objects form a repository of value (read only memory) for

programming commands and constants. Thus the so-called late Enlightenment, viewed as the revolution from above, which took place in Austria no differently than in the northern German states, simply replaced the mode of memory, installing a system not only capable of recording information, but also capable of erasing it: from eraser to “individual” to capital. We have forgotten that the city, as an event or data, once existed on its own apart from the state. More delicate, however, than the exchange of data is its formatting. In the case of the city, the modules upon which it has been built help to determine that format. The railway stations, which have (in the words of Napoleon III) ascended by the middle of the nineteenth century to the status of city gates, could not so readily give, as Joseph II did to Austria’s cloisters, a new function to the old portals, which had been up until that point the incoming/outgoing point for a postal system whose coaches transmitted people, goods, and news, that is, addresses, data, and commands. The railway not only stole the people and the goods away from the carriages of the postal system, it also assigned a new module or format to this information: in the carriages of the first class, the railway mobilized the officers; in second class, the lower ranking officers; and in third class, the battalion’s infantry.<sup>19</sup> This explains Benjamin’s euphemistic remark on “the historical signature of the railway”: it is “the first—and except for the ocean liner perhaps also the last—means of transportation which also forms the masses.”<sup>20</sup>

Traffic in the city, the masses of automobiles, need too to be formed or formatted. Richard Euringer, speaker for the National Association of German Writers, expressed the hope as late as 1935 that those “collisions, damages, injuries and bottlenecks,” which stem from the “freedom of self-propulsion” or auto-mobility, could be minimized through traffic regulations and the *Führerprinzip*.<sup>21</sup> The engineers, however, know better. The present-day computer gate—binary myths or horror stories to the contrary—does not take into account just two, rather it takes three possible circuit states into account: aside from the positive state “I” and the negative state “0,” there is a third state of higher impedance which isolates the corresponding data sources at their outgoing channel and thereby permits, after a short transition interval, other data sources to be transmitted by the same bus without collision. The yellow state on every stoplight performs the same function. In the endless circulation of green, yellow, red—or “I,” tri-state, “0”—the city’s countless streams of traffic (from the pedestrian to the bus) can be reduced to an alphanumerically digitizable data format, which a computer somewhere in the city’s central processing unit has also been tracking. Only an observer from an airplane or skyscraper—like Claude Lévi-Strauss in the megalopolis of New York City—can recognize once more behind the universal



discrete street machine, that analog or continuous flow of vehicles, which once was called traffic, but since has come to be known as frequency.

ADDRESSES are data which allow other data to appear. In order to connect a computer's memory to the data bus, the address bus first must address a single unit of memory, and secondly the command bus must address the entire memory. Media are only as good and as fast as their distributors. When books were still antique endless rolls, you couldn't very well flip to a page or double-check a reference. Even in a handwritten medieval codex, the page numbers were not of much help, since varying copyists had, each to a different degree, distributed the text widely or narrowly with each individual copy. Gutenberg's printing press first made it possible that "this page here resembles thousands of others,"<sup>22</sup> meaning it can be found, using the table of contents or index, in every printed edition. Cities are no different. It was the police prefects of absolutism (such as La Reynie in Paris) who saw to it that the hand-painted guild signs on the older houses conformed to the same standard and ultimately made them independent from the location of the house number.<sup>23</sup> From the national postal service to the public telephone to the license plate on every registered vehicle, media are at work replacing people with their addresses.

Stephan Daedalus, James Joyce's fictitious other, signed the front page of his geography book (of all books!):

Stephan Dedalus  
Class of Elements  
Clongowes Wood College  
Sallins  
County Kildare  
Ireland  
Europe  
The World  
The Universe<sup>24</sup>

A bit more prosaic, but no less specific, are personal ads which include a telephone number and/or a regional specification based on the license plate. Whether or not someone picks up the telephone receiver is of secondary interest. There is a good reason for that, too. It sufficed, legally, in the nineteenth century when the registered letter from the authorities landed in the mailbox, even when it could be proven that the addressee was never at the given address. "The nymphs are departed . . . have left no addresses,"<sup>25</sup> wrote Eliot, granted about nymphs and their playmates—but even river deities themselves are addresses. The read-

justment of the course of the Nadelbach, which later came to be known as the Tragisa or the Traisen, was cause for St. Pölten's historic first inscription: The Roman vice-magistrate Marcus Aurelius Julius dedicated an altar to Neptune, god of the waters.

Addresses, literally, create channels. They separate mountain streams from waterways, people from subjects, cities from capitals. Under highly technologized conditions, capitals scarcely need to be built; they only need to be assigned addresses. Paul Hindemith didn't write his didactic play "Wir bauen eine Stadt" (We're Building a City) in 1931 for bricklayers or architects, rather for the midrange frequency of the Southwest German Radio Corp.; and to be more precise, he wrote it for his brother-in-law, the Frankfurt radio mogul Hans Flesch.<sup>26</sup>

Founding a capital today means that at highway intersections and in train stations, in time tables and computer networks, a new "hub" arises, which centralizes the flow of energy and information. Even in the twenties, major European cities, in order to keep the dream of the center alive, didn't like to see their names on road signs. And "it was often the case that even the administrative agencies responsible for road work were unfamiliar with regions lying outside of the narrower confines of their borders, which is why they didn't appear on the road signs—sometimes even deliberately."<sup>27</sup> The strategic opening of space first placed the hub among the technological forms of animal life and began to number channels according to right-of-way. On computer buses, the tri-state commands regulate the right-of-way relations between "master" and "slave." On highways, it was Napoleon who instituted the concept of driving on the right-hand side of the road, thereby eliminating the chaos in the streets and clearing the national avenues, as well as the rows of poplars, for the marching columns of his autonomously operating divisions. It could also be said that it was the railway, at the very latest, which installed (in computer terminology) bidirectional traffic and gave modern media the model of divided lanes of traffic. Collisions have since then come to be known as derailings and passersby really are just passing by.

It was a provisional center stripe, which from February 1916 onward restricted French pedestrians, bicyclists, ox-carts, and so forth, from using the poplar-lined national highways, in order to better organize the transport, on the right, of munitions and, on the left, of corpses, that saved the besieged city of Verdun from the bloody imperial "gristmill." This improvisation of the enemy was turned by Guderian,<sup>28</sup> the World War I tank commander of the Wehrmacht, into the center stripe—with an eye toward the next war—on his autobahn. "The counterattack—as a general rule in the art of war—never attacks same with same. Rather against artillery you have the tank, against the tank, the helicopter, and

so forth. The war machine thus possesses a factor of innovation, which differs radically from the innovations of the machines for production" (*MP* 494).

COMMANDS, although termed "instructions" in the pedagogically modest Anglo-American of the inventors of the computer are, in fact, orders. An analogy without algorithm, which requires its own auto-execution, might have been left, as it has been in the past, up to the resourcefulness of mathematicians. Data processing, however, makes the genius or the boss superfluous.

Because in the final analysis "to command" simply means "to address." This is true for the lowest level of digital computation devices, in the so-called microcode, where the patent wars are the most vicious; and it also applies, as Althusser's analysis illustrates, to the lowest level of everyday city life: a citizen is anyone whom the cry—"Hey, you there!"—of a police officer on the street causes to stop and turn around.

Command centers thus aren't rooted in the forest of symbols planted by a power. Rather they spring up in the less obvious tangents that, like bridges, connect them with unflattenable graphs.

If it is true that the first ministries in Prussia originated from a central privy council, the bureaucrats of Kafka and Austria know better. The central administrative authority during Kaiser Maximilian's reign did not arise out of the aristocratic agency of the Roman-German emperor. On the contrary, this is an entirely technological moment of liquidation in Austria: the Hapsburgs came into power step by step with the bourgeois lawyers in their chancery court. Chancery courts for the individual states followed, linking cities and provinces to the hub, the capital.<sup>29</sup> Power thus means occupying at the right moment the channels for technological data processing. And centrality becomes a variable dependent on media functions, rather than vice versa.

On April 9, 1809 Kaiser Franz II declared war on France. Within days his patriotically charged armies had crossed internal borders. A letter to the Bavarian monarch, containing the order to sever the treaty with Napoleon, went unheeded. So the Austrian forces of war set out to deliver the transmitted information personally and marched on Munich. King Max fled, but the French envoy had just enough time to get off a courier to Strasbourg where Napoleon's staff general Berthier was headquartered.

France's border cities had been connected to the capital since the creation of the fourteen independent armies of the revolution in 1794 by optical telegraph, the first high-speed transmission system in history. Berthier thus had no problem dispatching a telegram to Napoleon in Paris, and Napoleon could then telegraph his army; until the French, in the record time of two weeks, had liberated Munich. As a result, the

Bavarian ruler commissioned his academy of science to develop an improved telegraph, the electric telegraph.<sup>30</sup>

Napoleon's war machine meanwhile marched onward to Wagram and unified Europe with the optical telegraph (just as the Roman postal system had once done with its pony express). Church steeples, which for centuries had been the one and only channel between power and people, were assigned a new function. "On the northern face of the cathedral's steeple" in St. Pölten, the occupation army installed "a 'telegraphic machine,' which was part of the pipeline of military information running from Vienna to Strasbourg. This pipeline consisted of military outposts placed on towers or overlooks and stationed at one-to two-hour intervals; signals could be transmitted using three flags (blue, red and white) whose meaning was only known to the 'directors' at the end of each line."<sup>31</sup> While the equally functional tricolor flew above Austrian cities, foreign forces of the Enlightenment surveyed the Austrian countryside, which maps since the *Peutingeriana* had more or less ignored. Marshall Marmont, for instance, dispatched a cavalry division to cartographically document the mountains, valleys and marshes around St. Pölten, whose very impenetrability cracked the code on a new technology of warfare.

Since then, armies have been able to bypass cities and, moreover, capitals. Over mountain ranges, through swamplands, or across desert sands, the Blitzkrieg attacks the enemy from the rear, seeking to enclose spaces rather than cities. The sole prerequisite is a precise map, once top secret information but increasingly after 1800 the monopoly of staff generals in France, Prussia, and Austria.

The total air war beginning in 1942 reconstituted the urban centers. The module for destruction, however, has ceased to be "man." Rather for phosphorous bombs it is a city; for uranium bombs, a major city; and ultimately for hydrogen bombs, megalopolis. The wide green spaces and broad arteries of life in the cities of the Federal Republic are indeed a small consolation, even if they do originate from architectural plans made during the World Wars to avert the next bomb terror.<sup>32</sup>

The "invisible city," with which Mumford concludes his world history as the history of the city, consists of more than mere information technologies operating seamlessly and at the speed of light. The computer commands for deletion are also ready to be called up. "This is the last and worst bequest of the citadel (read 'Pentagon' or 'Kremlin') to the culture of cities."<sup>33</sup>

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(Translated by Matthew Griffin)

## NOTES

- 1 This essay first appeared in a volume on Vienna, *Geburt einer Hauptstadt am Horizont*, ed. Dietmar Steiner, Georg Schöllhammer, Gregor Eichinger, and Christian Knechtel (Vienna, 1988); it was reprinted in *Mythos Metropole*, ed. Gotthard Fuchs, Bernhard Moltmann, and Walter Prigge (Frankfurt a.M., 1995), pp. 228–44. [Tr.]
- 2 Paul Valéry, "La conquête de l'ubiquité," *Oeuvres*, vol. 2 (Paris, 1960), p. 1285; my translation. All subsequent translations are my own unless otherwise noted.
- 3 The author puns on the German word *Hauptstadt*, literally "head-city," a translation from the Latin *capitalis*, which means "at the head, foremost or chief" and stems from *caput/capitis*, the "head." [Tr.]
- 4 Michel Foucault, *The History of Sexuality*, vol. 1, tr. Robert Hurley (New York, 1978), pp. 88–89.
- 5 Gilles Deleuze and Félix Guattari, *Capitalisme et schizophrénie: Mille Plateaux* (Paris, 1980), p. 539; hereafter cited in text as *MP*.
- 6 Martin Heidegger, *An Introduction to Metaphysics*, tr. Ralph Manheim (New York, 1961), p. 152.
- 7 Joachim Jäger, *Elementare Topologie* (Paderborn, 1980), p. 129.
- 8 Didier Gille, "Maceration and Purification," *Zone Magazine*, 1:2 (1986).
- 9 St. Pölten is the capital of southern Austria and has its own independent charter. [Tr.]
- 10 The Traisen, a tributary of the Danube, flows through St. Pölten. [Tr.]
- 11 See Christopher Alexander, "A City is not a Tree," *Design Magazine* (1965).
- 12 Paul Valéry, "Présence de Paris," in *Oeuvres*, vol. 2, p. 1015.
- 13 Johannes Lohmann, "Die Geburt der Tragödie aus dem Geiste der Musik," *Archiv für Musikwissenschaft*, 37 (1980), 167–86.
- 14 Harold Adams Innis, *Empire and Communications* (Oxford, 1950), p. 71. The Achaemenid dynasty ruled in Persia from 550 BC to 331 BC. [Tr.]
- 15 Lewis Mumford, *The City in History: Its Origins, its Transformations, and its Prospects* (New York, 1961), p. 569; see also Lewis Mumford, *Megalopolis: Gesicht und Seele der Groß-Stadt* (Wiesbaden, 1951).
- 16 Alan Turing, "On Computable Numbers, with an Application to the Entscheidungsproblem," *Proceedings of the London Mathematical Society*, 2:42 (1936), 23–165; see also *Mechanical Intelligence*, ed. D. C. Ince (Amsterdam, 1992); and Alan Turing, *Intelligence Service: Schriften*, ed. Bernhard Dotzler and Friedrich Kittler (Berlin, 1987).
- 17 See Friedrich Kittler, *Grammophon Film Typewriter* (Berlin, 1986).
- 18 See August Hermann, *Geschichte der Stadt St. Pölten*, 2 vols. (St. Pölten, 1917–1930).
- 19 Sven Hedin, *Ein Volk in Waffen: Den deutschen Soldaten gewidmet* (Leipzig, 1915), p. 75.
- 20 Walter Benjamin, *Schriften*, vol. 7 (Frankfurt a.M., 1982), p. 744.
- 21 Richard Euringer, *Chronik einer deutschen Wandlung, 1925–1935* (Hamburg, 1936), p. 263.
- 22 Hans Magnus Enzensberger, *Mausoleum: Thirty-Seven Ballads for the History of Progress*, tr. Joachim Neugroschel (New York, 1976), p. 4.
- 23 See Jacques Saint-Germain, *La Reynie et la police du Grand siècle d'après de nombreux documents inédits* (Paris, 1962).
- 24 James Joyce, *A Portrait of the Artist As a Young Man* (New York, 1928), pp. 11–12.
- 25 T. S. Eliot, "The Waste Land," in *Selected Poems* (London, 1954), 3.179–81.
- 26 See Wolfgang Schivelbusch, *Intellektuellendämmerung: Zur Lage der Frankfurter Intelligenz in den zwanziger Jahren* (Frankfurt a.M., 1983).
- 27 Kurt Kaftan, *Der Kampf um die Autobahnen: Geschichte und Entwicklung des Autobahngedankens in Deutschland von 1907–1935 unter Berücksichtigung ähnlicher Pläne und Bestrebungen im übrigen Europa* (Berlin, 1955), p. 13.

- 28 Heinz Guderian oversaw the expansion of the Autobahn after World War I. [Tr.]
- 29 See Otto Hintze, "Der österreichische und preußische Beamtenstaat im 17. und 18. Jahrhundert: Eine vergleichende Betrachtung," *Historische Zeitschrift*, 86 (1901); see also "Der Beamtenstand," *Vorträge der Gehe-Stiftung zu Dresden*, vol. 3 (Leipzig, 1911).
- 30 Rolf Oberliesen, *Information, Daten und Signale: Geschichte technischer Informationsverarbeitung* (Reinbek bei Hamburg, 1982), p. 241.
- 31 Herrmann, *Geschichte*.
- 32 Manfred Durth, *Deutsche Architekten: Biographische Verflechtungen 1925–1970* (Munich, 1987), pp. 252–68.
- 33 Mumford, *The City in History*, p. 569.