



# MATHEMATICS:

(a novel)

# JACQUES ROUBAUD

"Roubaud is a writer of simmering passions,  
of secret pleasures."—*L'Hebdo*



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JACQUES ROUBAUD

translated by IAN MONK

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Originally published in French as *Mathématique*: by Éditions du Seuil, 1997

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First edition, 2012

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Library of Congress Cataloging-in-Publication Data

Roubaud, Jacques.

[Mathématique. English]

Mathematics : (a novel) / Jacques Roubaud ; translated by Ian Monk. -- 1st ed.  
p. cm.

"Originally published in French as *Mathématique* by editions du Seuil, 1997."

ISBN 978-1-56478-683-8 (pbk. : alk. paper)

I. Monk, Ian. II. Title.

PQ2678.O77M3713 2012

843'.914--dc23

2011041212

Partially funded by a grant from the Illinois Arts Council, a state agency,  
and by the University of Illinois at Urbana-Champaign

Ouvrage publié avec le concours du Ministère français chargé de la culture –  
Centre national du livre

This work has been published, in part, thanks to the French Ministry of Culture –  
National Book Center



[www.dalkeyarchive.com](http://www.dalkeyarchive.com)

Cover: design and composition by Danielle Dutton, illustration by Nicholas Motte  
Printed on permanent/durable acid-free paper and bound in the United States of America

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*People who like this sort of thing will find this the sort of thing they like.*

—Abraham Lincoln



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# MATHEMATICS:

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## Chapter 1

### *Incipit Vita Nova*

#### **1 There were three exits**

There were three exits: the first one was at the top, to the left, looking down toward the blackboard. It was the main entrance to the lecture hall (or “amphi,” as we called it), and the door around which, long before the session began (at 8.00 or 8.30 A.M. it was still dark; winter time, and thus dark outside, without details, black), the students huddled together in the hope of getting the best places (the ones where you not only had a seat, but could also hear the lecturer’s voice clearly: a luxury). In front of the door stood the distributors of ‘political’ tracts, so long as they managed to evade the vigilance of the college janitor (→ § 10)\* who constantly tried to chase them out onto the street, in front of the railings on rue Pierre-et-Marie-Curie, or at least onto the steps in front of the main entrance. They stuck to it obstinately, aware of the global importance of their cause.

I used to arrive early (I always arrive early), to sit almost at the top of the “amphi,” nearly in line with the door, in the “Mountain” section of this assembly (to use the political terminology of 1793), or perhaps of this fake Convention, whose supposedly studious students, sitting farther down in the front rows, made up the

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\* Such cross-references direct the reader to the interpolations following each chapter, and the bifurcations (B) following chapters two and three.

“Marsh.” My preference was a place at the end of a row, on a narrow uncomfortable bench, where I would have just one neighbor to my right, and where the neighbor to my left was not the wall, as it would have been farther down, but a glass panel.

The lecture hall filled up, the noise of conversations gradually gave way to that of paper and the scratching of chalk on the board while, through the steam formed by breath, behind the filthy glass, I could see the night, almost attentive, nearby, slowly evaporating in its dampness to give way to a pale, dull daylight.

Between the beginning and end of the lecture, this nocturnal darkness abandoned the city and was replaced by a gray, wintry penumbra. But at the instant when I first sat down, taking my uncomfortable narrow place inside that collegiate volume made up of trapezoidal sections (inverted rectangular trapezoids, their bases up towards the sky), which was still almost empty, and while the pane was still clear of misty breathing, I could see myself, looking outside, almost outside of myself, just next to the night, contiguous with its ever-impenetrable, blue, somber mass.

Outside, the sunrise was slow and feeble, penetrating that studious hum only barely, insufficiently, surmounting with difficulty that pallid, cold, electric light. This was a difficult period, during the 1954–55 academic year; the place: Institut Henri Poincaré—in the Hermite lecture hall; certificate: Differential and Integral Calculus, taught by Monsieur G(ustave) Choquet.

I turned to see my image take form somewhere in the air outside, thus obeying the most basic and unvarying laws of geometric optics (General Physics Certificate), then become covered with steam before misting, fading, and disappearing. It was nighttime

in winter. It was cold: cold outside, and cold in the ill-heated “amphi.” I placed my hand on the bare glass, I pressed my palm on it to wipe away the steam and see my face better, as well as those of my studious neighbors, but above all to wonder numbly at the enigmatic quality of that paradoxical light, bathing those suspended faces in the outside air, without any support, a yellow light both electric & virtual, illuminating this pocket of icy space, excavated from unbending night.

So I listened absentmindedly, lazily taking notes in my exercise book, jotting down almost illegible scraps of some definition or other that didn’t seem too off-putting, or some obvious corollary to a theorem that remained thoroughly mysterious in itself. If, that is, there were any decipherable traces of these explanations still left on the board.

But “Choquet”—we said “Choquet” as you might say “Schwartz” or “Bouligand,” with audibly implicit quotation marks, which are less a mark of off-handed familiarity than a form of citation, an apparently individualized but in fact impersonal naming of the “professor function,” which would become colored only subsequently, as the “year” advanced and the month of exams (June) approached, with a collective halo of reaction, be it of rejection or acceptance, or else with concerns and anecdotes, before, as becomes an oral tradition, being classified, refined, complicated, deformed, then handed down to the following year’s students, in this way gradually building up professional legends around certain names and becoming distinctly singular “portraits” of their bearers—but, as I was saying, “Choquet” rarely wrote anything on the board. He talked through his mathematics, without notes,

sometimes making geometric gestures in the air with his hands.

Mathematicians, as portrayed in the typical, spontaneous reactions of the populace when someone first meets you and learns that you're someone who does "math" (always coming just after the ritualistic statement: "I was hopeless at math at school"), are individuals who express themselves in a language that is incomprehensible to almost everyone else, and are thus prestigious, defining truths that are at once essential and obscure. The reaction of the listeners in the Calculus lecture hall in 1954 to Choquet's opening words, as he spoke for the first time in this role (in this function) in this place (he had just taken over from "Valiron," one of the last representatives of the old "French" school of analysis), was extraordinarily similar to the general reaction of non-mathematicians: alarm. Whatever their mathematical past had been, they had not been expecting this.

## 2 A few years ago, my friend Pierre Lusson and I

A few years ago (in the mid 1980s), my friend Pierre Lusson and I had a very pretty young colleague at the Department of Mathematics of the University of Paris-X, Nanterre, who was an ATER (or *assistante transitoire d'enseignement et de recherché*, unless I am mistaken (which I may well be: already the names, acronyms, and images from such a still-recent past are misting over (in fact, all such images and memories become covered with mist as soon as you breathe on them to warm them up, after which they fade away, stuck through with inexactitudes))). And, one Monday morning, when we were together in our department's tiny office,



seeing Sonia yawn slightly as she removed a sheet of logic exercises from her satchel (her satchel? no, from her “briefcase”; I really should refrain from using such language: the word “satchel” must already be prehistoric), Pierre said to her (words to the effect of): “When you dance on weekends, you yawn on Monday!” She nodded. Then we chatted for a while on the subject.

So Pierre, encouraged by this initial conversational success (he was, and is, like Kipling’s “elephant’s child,” full of “satiabile curiosity”), but also pleased to be able to use a vocabulary suited to the occasion, thanks to information gleaned from his daughters Juliette and Cécile, prompted Sonia further: “And when you go ‘clubbing,’” he asked, “do you tell your dancing partners that you’re a mathematician?” Sonia answered at once: “Of course not! I did once, and once is enough!”

For, confronted with Mathematics so unexpectedly, unforeseeably, and embodied all at once not in the rather off-putting features of the traditional teacher or schoolmaster, or else in the general public’s caricature of the mad professor, but instead in a young woman, and one who was, to top it all, as pretty as Sonia, the dancer’s reflex reaction had been to run away.

In the same way, now confronted by the sudden metamorphosis of mathematics that was occurring before their very eyes (or, rather, their very ears), even the most war-hardened students from the *classes préparatoires* or survivors from the massacre that had taken place during the two sessions of the General Mathematics Certificate, felt their most firmly rooted convictions waver: during their previous studies, they had formed an idea of mathematics that had gradually become invariable, tame, and stable; but

now, suddenly, they found it so altered that it was closing itself up hermetically right there in front of them. And, generally speaking, they did not find its new features to their liking.

An almost palpable dismay could be felt among those who were retaking the course: they failed to see any common point between the lessons given by “Valiron” the previous year and the ones now being delivered by “Choquet”; it was as if one science had been replaced by a different one during the summer holidays, and had been given the same name simply for practical reasons.

Some, like Sonia’s dance partner, fled and changed directions for good. Others found this turnabout hard but amusing, and then, in the end, seductive. Most just set about trying to learn (and perhaps understand) what was being explained to them. And isn’t this the real essence, or utter banality, of education: listening (reading), remembering, then reconstituting everything without thinking too much? But this was an exceptional situation, and everyone was aware of it. There had been a rupture: a tradition that had become a routine had just collapsed, and then—with nonchalant ostentation—something else had begun (which they were involuntarily witnessing). It was clear that “Choquet” was amused at their, or our, disarray. Apparently, a clean slate had just been made of the past of mathematics (→ § 11).

When looking in from the door, as I am doing in this memory of that moment, the rectangle of benches, tables, and tiers looked like a page, generously punctuated with signs of attentiveness, with the board being its “header,” and, standing in front of it speaking, the professor (as opposed to “literary” types, mathematicians always lecture on their feet). The hall had already been full

even before he began. The intimidating newness of the material and the absence of textbooks (the previous incumbent of the post, Professor Valiron, had written a book, which all of the students owned; apparently, during his final few years of teaching, he had done nothing more during class than write some rather obscure comments about a few chapters of it on the board) made attending these lectures obligatory.

In those days, the professor didn't enter the lecture hall through the same door as the students. There was another entrance lower down, just beside the immense blackboard that was made up of three jointed sections that, barring breakdowns or human error, could be slid one over the other at will, using the buttons of a control panel placed on a long table between the board and the first row of benches. (Unless it was just below the blackboard itself; or else to one side; actually, I have no idea: all I have to do is to think of one or other of these possibilities and I can picture it at once!)

(I am standing, looking down from the heights of the lecture hall; I can see it spread out beneath me, half full. It is nearly time for the lecture to begin. The world from which this image of the past emerges has just been born, and it will end when the image ends, that is to say just following these words, or almost at once. I can see the smooth, dark surface of the board, covered on the left by the marks of rubbings-out, forming a cloud of fine chalk dust; and also a drawing consisting of two rather irregular ovals, or "potatoids" as one might say, which are overlapping and intersecting, their shared section filled with cross-hatching. The intensity and physical proximity of that black surface and that drawing are the main characteristics of this memory; they are so close, so clear

before my eyes that they must be showing something real, something that has been.)

### **3 Behind that door lay a protected space**

Behind that lower door lay a protected space, a professorial sanctuary: not an office, but a miniature classroom with a board, table, chair, chalk, more chalk, and even more chalk. No one was allowed inside without express permission, in order to ask a question, to request an explanation or else advice.

The professor's ceremonial entrance, though far more modest than the pomp then reigning at the Sorbonne (as in the aptly named Richelieu lecture hall, where I had attended Professor Martinet's lectures on General Linguistics once or twice), symbolized not only by the venerable shadows of its antique décor, but also by the presence of a porter (and I won't mention the Collège de France, where the lecturer's appearance/arrival on stage is still, to this day, solemnly announced), nevertheless served to maintain a strict distance between the two relative poles of this "aural" communication of knowledge: that is to say, the emitter (or professor) on the one hand, and on the other the receivers (or students: us, me). It took me several months before I dared go through that lower door for the first time. And I was to do so only on a very few occasions.

Much later, particularly during the 1970s and the long decline of the IHP (pronounced "EEASHPAY," the Institut Henri Poincaré's pet name), which had been deserted first by the students, whose numbers had swelled to bursting before they were finally

dispersed, after the tumult of May '68, to the multiple new universities that had grown by way of cell proliferation out of the former obese and solitary University of Paris, then little by little almost emptied of all its strictly mathematical activities (some of which only returned a few years ago), while those few who refused to abandon it entirely to physicists kept up a rearguard action by organizing "seminars" in small groups to work in front of this or that blackboard (with the corridors and halls nearly empty), I would often go back, almost clandestinely, to that little room.

In May or June, as the end of the academic year provided plenty of opportunities for semi-studious, semi-nostalgic wanderings, I arranged to work there on certain Saturday mornings, when the two "amphis" (Darboux and Hermite), as well as "rooms U or V" on rue d'Ulm (a proper Heisenbergian designation), which would have been my first choices, had already been booked, with my "pupil" ("Bonnin," from Dijon) and with the pupil ("Pallo") of my pupil ("Bonnin"), for long sessions of "parenthetical calculus" (translated into "Polish notation"—a cabalistic process, no doubt, to the layman's eye—the long sequences that we built up were based always on the same two symbols—"alphas" and "points": for example, "alpha point alpha point alpha alpha point point point" ( $\rightarrow$  § 12)).

As the morning wore on, it became hot. I opened the little frosted-glass window that looked down onto an alleyway running alongside the building toward a gate situated between the Institutes of Geography and Oceanography; then, between the alley and the street, the sun began to pick out the points within the vegetal confusion of its own sequences, which were far more incomprehensible, varied, and entangled than our own.

The third entrance to the lecture hall opened onto this alley: another door, lower down still, this time to the left of the blackboard ( $\rightarrow$  § 13). But it could be opened only from the inside. Thus, when late and dashing from the intersection of rue Saint-Jacques and rue Gay-Lussac along this ill-lit wintry track, bordered by the lofty forms of bare trees and mysterious brick laboratories, which would have been as rosy pink as Toulouse without their shroud of soot, it was not possible to go into the lecture hall this way. You had to go right around the building, in one direction or the other, either toward the front steps and the main corridor, or else back to an external concrete staircase that led to another corridor, which ran perpendicular to the one above, alongside the “Common Room,” before joining it in front of the main entrance.

It was through this third exit that the crowd of students from the front rows emerged, dazed, as soon as professorial silence had fallen. They then headed for a café, a library (“Sainte-Genève” or “La Sorbonne”), the metro, the Luxembourg Gardens (or “Luco”), other lessons, the nearby Ecole Normale Supérieure on rue d’Ulm (that is, for those students of the Ecole Normale, along with their intellectual or sentimental associates, who had deigned to drag themselves as far as the IHP, a place so unworthy of their standing. But that year, quite a large number of them came to listen to “Choquet,” who was not considered to be undeserving of their august presence. Though, presumably to reestablish a sense of balance after making such a compromise, slumming among their inferiors, some of them made a point of displaying their condescension by causing a disturbance in several of the rows with their muttered



chatter, while others still sought to distinguish themselves by their singular dress sense, such as “Douady,” who would sometimes turn up in the middle of a lecture barefoot and in pajamas.)

In those days, murmurs or even the occasional disturbance were not forbidden—such things are as ancient as universities themselves—and comings and goings in the upper reaches of the lecture hall, around the main entrance, were likewise tolerated. But these were merely impersonal, collective agitations made by a mass of indiscriminate faces. No one made his own voice heard alone. And, above all, no one interrupted the didactic flow of the professor’s words to ask a question in public, to express a doubt, or, worse, point out a mistake.

Such were the general rules, at least in science lectures. But that winter, the auditorium remained, if not attentive, then at least particularly silent, for the entire hour. The proverbial pins that, in our old “cooked” language, frequently drop in lecture halls, would for once have made themselves heard. And I should emphasize how these silences had a particular density and tonality. But they were not the result of any sort of emotion, fascination, or even applied concentration. Above all, they demonstrated a perplexity, or even stupefaction. A stupefaction that I shared.

#### **4 This book will no doubt only feebly justify its provocative title**

This book will no doubt only feebly justify its provocative title. I should make that clear before proceeding any farther. To suggest otherwise would be not only dishonest, but also absurd. Our

ancient, venerable, and ever-young ancestor, Mathematics, born it is said twenty-six or -seven centuries ago on the shores of the Aegean Sea, will not find a paper monument worthy of itself in these pages. But then, it hardly needs one.

The author of this book (the person, here, who is saying “I”) is (or, rather, was) what could be called a mathematician. He (I am referring to me) devoted a very large number of hours to studying, teaching, and slowly ascending a few rungs of the university’s professional ladder, from junior lecturer to lecturer to senior lecturer to professor without chair (such terms are no longer used or else have changed their meanings) to full professor (but not up to the top rung of the ladder), while attempting to add to the sum of ideas and results that constitute mathematics, though actually contributing to its advancement in only an extremely obscure manner. I was one among many, just another person among that very large, increasingly large number of people who stubbornly try (even if the immense majority of them find only negligible success) to modify and reconfigure its features. So, if it were necessary to erect a monument to that science, I would not be the person best qualified to do so, far from it.

But it is also true that this book’s title could hardly be different. Mathematics, or at least the idea of mathematics, or rather the ungraspable mass that in its totality makes up (or, more restrictively and precisely, constitutes it as a science (its branches, concepts, theorems) for anyone else as well as for me, during the years of my total immersion in its labyrinth), **Mathematics** is precisely what gives this book its point of departure, its *impetus*, and, symmetrically, will lead to its projected end, to its conclusion, to an

elucidation of the very meaning of its existence, to an answer, no, to the answer to the question posed by all books: why?

But, in the end, this is merely a special case of the relationship that unites a book to its title, which I shall set out here as an axiom, borrowed from Gertrude Stein:

axiom    **A title is a proper noun describing a book.**

Thus, a book is merely what answers (or tries to answer) the question: why this title? It is a special case, in terms of the axiom given above, of the question (or the enigma if you prefer) of proper nouns: what unites a proper noun to the “singularity,” the absolute, irreducible, rigid singularity that bears it as a name? To put it another way: a book is the autobiography of its title and, as such, the narrative of a singularity (→ § 14). The colon that follows the word “Mathematics” in the title I have chosen for this branch of my work (a prose continuity/discontinuity that exceeds the number of pages you are reading) was set there with precisely this in mind.

I open my window to the air that will remain nocturnal for a few moments more; it is a time between night and day, between four and five o'clock in the morning; at the beginning of May, on rue d'Amsterdam, in the ninth arrondissement of Paris. The air outside (in the courtyard) is cold, while the dark blue of the sky dissolves and lightens. I have waited over thirty-seven years before daring to stop and stare deliberately at that image, or handful of images: the board, benches, heads, chalk drawings, charged with meaning. I remove it from its hell, or its limbo. I remove it

from my memory so as to erase it, as I do with all the memories that I fix by writing them down, like the chalk “potatoids” drawn by “Choquet” on the blackboard, long ago.

But before erasing it, I charge it with meaning: the meaning arrives only afterward, I am aware of that. I am even aware that, year by year, with no conscious searching of my memory, a given image will have become encumbered by a large number of successive, confused, incoherent, perhaps contradictory meanings, and that the one I am giving it today, which is not all that clear itself, is merely their result, while also being complicated and deformed by my intention: namely, to begin this “chromatography” upon the blotting paper of that solitary, punctuated word standing as my title, **Mathematics**:. This image, or collection of images entwined around one another, came back to me almost uninvited in the icy May air, and of course entered quite by chance into resonance with the icy May air in my story; or else, by way of some unrecoverable association, with that other cold, semi-nocturnal air, wintry too, in 1954; but it or they also appeared in response to a narrative decision (→ § 15).

It’s also true that, for the past few months, the mathematician I used to be has begun a far more open relationship, free of obligations, in part ludic and lacking in any great seriousness (in the terms of the actual institutions of the mathematical community), with what once was, for only a little under the thirty-seven years I mentioned just now, the basis of my professional life. I no longer teach it, as such, according to a recognized program condoned by a university (the University of Paris-X, Nanterre, in my case). It plays only an incidental (though inevitable) role in the “course” or

“seminar” on “Formal Poetics” that I lead at the *Ecole des hautes études en sciences sociales* (EHESS).

And it is probably for this reason that I no longer feel guilty, not about giving up being a “pure,” productive mathematician in the middle of the 1970s, which in any case I had only been rather infrequently (“productivity” in mathematics does not depend entirely on one’s will), but more about unforgivably abandoning—not entirely, but still to a great extent—the arduous yet necessary efforts to follow the progression and advancement of the ideas in the two or three regions of mathematics in which I had managed to understand, or thought I had understood, what was at stake. This change of status, thanks to the partial institutional recognition of an “applied mathematical” dimension to my efforts in a highly particular and, for many, frivolous direction (that of “poetics”!), which took over from actual mathematical research during that same period, freed me to a certain degree from the moral obligations (created by remorse) that I felt toward what had once been a lasting passion. I was now free from its ties, and able to envisage undertaking what this book will become. I could only have done so by acknowledging my renouncement.

## **5 What caused the anxious stupor of the Integral and Differential Calculus students**

What caused the anxious stupor of the Integral and Differential Calculus students in the 1954–1955 academic year was the sudden arrival onto the scene, within a field of knowledge that had seemed stable and been deemed worthy of transmission, of some-

thing strange that would, under the name “Modern Mathematics,” turn into an unstoppable wave swamping the entire educational system, despite a certain dogged resistance.

During the next few years, that drawing, whose presence on the blackboard in the Hermite lecture hall I’ve already mentioned, with its two intersecting oval “potatoids” and their common section highlighted for the eye by cross-hatchings (a particularly aggressive caricature of a geometric figure, elementary and entirely “trivial” and whose mathematical content is next to zero (weaker in any case than the rectangles, squares, and diagonals sketched out by Socrates in *Meno* ( $\rightarrow$  § 16))), was destined to spring up all over France: in schoolbooks, on desks, in the sand, in the snow, and on the blackboards of every classroom of every order and variety of education.

Here it is, in all of its emblematic simplicity:

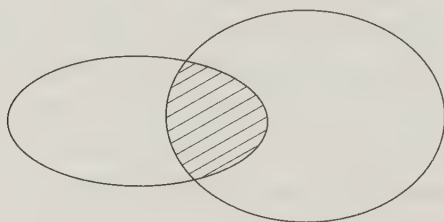


Fig. 1

We looked. We did not understand. We did not understand what there was to be understood, in what way this was a part of mathematics (accustomed as we were to algebraic calculus, derivatives, integrals, and “conics”). Its symbolic “translation” was then written onto the drawing.



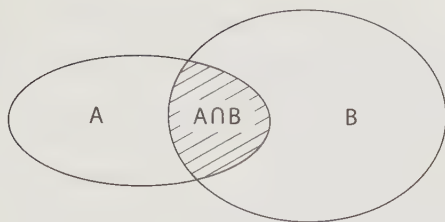


Fig. 1 (with caption)

The reasoning that followed, built up on drawings barely more complex than the first one, and using a very small number of special symbols, seemed both obvious (of an extremely low level of deductive complexity) and yet incomprehensible when applied to its purpose. Most of the students felt (as pupils from primary school up to university would later on) as though they were falling into hostile territory without a parachute.

But we were going to have to get used to it. At the end of the university year, now just a few months away, there would be exams. And these exams had to be passed. There were those who succeeded and those who failed. I did neither one nor the other. We shall see why later.

At present, I am simply marking the sociological importance of the moment. That year's students were the first to become math teachers having drunk at the source of what was wrongly and pompously called "set theory" (it has to be admitted that its theoretical element verged on the nonexistent). Brutally plunged into secondary schools, they rapidly became aware of their uniqueness, their originality. It must be said that many of them underwent a

genuine conversion ( $\rightarrow$  § 17) to a way of seeing mathematics that was felt to be new, daring, original, and categorical. Thus, like Luther's first disciples, they became the zealous reformers of Modern Mathematics (variant: like the adherents of the Third International after the Congress of Tours, they were the first Bolsheviks of a new revolutionary doctrine).

I, too, was there at the beginning, among them.

## **6 The moment that I am marking out, symbolically, one winter morning,**

This moment, the moment that I am marking out, symbolically, one winter morning, by evoking a particular place in a lecture hall, while associating it no less symbolically and no less arbitrarily with the “set” figure on the board, is something that I now see as having been surrounded by extreme difficulty and dismay: it was doubtlessly the first of those moments, which have been rare but remain darkly memorable, when the huge distance between the heights of an intention or ambition (here intellectual, on other occasions artistic) and my own progress in achieving them were made clear to me—or, rather, blew up in my face—thanks to a sudden realization that my present situation represented said heights’ near-precise mirror image.

I wasn't a “natural” mathematician, wasn't one of the ones with an early vocation, accompanied by sudden, spectacular success and institutional encouragement, leading almost inevitably along what is, in France, the privileged path toward that reservoir of geniuses, that breeding ground of talent, that coaching facility for

high-level athletes of this particular Olympic sport, which is the Ecole Normale Supérieure, Section des Sciences.

This comparison with athletes is inevitable. One of the received ideas about mathematics (and like many received ideas, it contains more than its share of imbecility) is that mathematicians emerge at a very young age, prove themselves when just as young, and remain inventive and productive only for a few years, after which, as in the nineteenth century view of women (the title of Balzac's novel *A Woman of Thirty* tells its own tale), they rapidly lose their mathematical sparkle and charm. Such, indeed, is the fate of hundred-meter sprinters, whose discipline is considered to be the purest and most beautiful athletics has to offer. For, once age has robbed an athlete of his gift, there is only one thing he can do: become a talent spotter or coach for future generations.

According to this universal understanding, which has reached its apogee in France, of mathematicians as science's version of "sprinters," the best of the lot, the real champions (both in the sporting and medieval sense) are the fastest and most precocious: they come first in essay competitions in their earliest childhood, then in all their oral or written exams, they win national prizes, obtain places in the best colleges, then subsequently pass the entrance exam to the Ecole Normale Supérieure, before brilliantly and just as rapidly answering questions that have been left in suspension by previous generations of athletes just like them, proving theorems by the dozen and then, finally, as exceptions among the exceptional, winning the equivalent of an Olympic medal by discovering and, above all, proving the spectacular result that will bear their name.

Such was not my ambition. Which is just as well, because I would never have fulfilled it. My gifts and grades were insufficient. Previously, I had shown only a rather distant interest in this subject (the sciences lay far from my preoccupations: I wanted to be a poet). I hadn't chosen this *cursus* on entering university. And yet, one day, I decided to be a mathematician too. But in what sense? Herein lies a difficulty of definition.

It didn't become clear to me at once. Initially, a little over two years before the moment in which I placed myself at the beginning of this chapter, or to be more precise in the month of June 1952, I began to be gripped by a sort of revelation. I was going to change directions decisively. I was going to drop the studies I had already begun—an English degree that was almost finished, and a Russian diploma from the School of Oriental Languages—and set off along a radically different track: I would start from scratch, so to speak, and begin all over.

This would not mean, however, any deviation from the route that mattered most to me: poetry. The simple fact was that I had just decided (or discovered) that this route in itself would not only fail to provide me with a place in life that was likely to put food on the table (it was not a “viable” profession; in fact, it should not be a profession at all, according to my rather unoriginal notion, indirectly influenced by Surrealism, even if such a thing had been possible, which it wasn't), but, even more seriously, I had arrived at the conclusion that all forms of literary education, and not just French literature, were contrary to the idea of poetry as an act of invention: “practical criticism” of a sonnet from Nerval's *Chimeras* in my penultimate year at Lycée

Louis-le-Grand was the root (though identified only *a posteriori*) of this judgment.

So, I said to myself: **I'll be a mathematician!** (→ § 18). It was an idea, just an idea, but it was a sudden idea, an exhilarating, overwhelming, illuminating idea (→ Bif. A). I had no real understanding of what it meant, or of the thankless years of laborious study that lay behind it, nor indeed about the qualities deemed to be necessary in order to gain some recognition or status in this field. I thought it was just a question of making a decision, as it had been for poetry. I said to myself: I'll be mathematician, just in the same way as I had said to myself: I'll be a poet (I knew that I wasn't one, not yet, but I hoped I would become one); and I would do so quite simply because I wanted to.

It was a sublime idea. It illuminated me all summer. From afar.

## 7 I have highlighted an analogy

I have highlighted an analogy: I wanted to be a mathematician, just as I had wanted to be a poet, by virtue of a decision. But, for me, the two decisions were not of the same type. Being a poet means composing poetry. It is, above all, about composing poetry. Being a poet is first and foremost being a poet at a given time, with nothing secondary or provisional about it. Such, at least, were the convictions behind my decision.

Thus, I could not want (and even less decide) to be a mathematician in the same way as I wanted to be a poet, according to the same precepts. Which is to say, when I made my decision, I did not want to compose or invent mathematics.

(In truth, I didn't know what that really meant. School as an institution, during my years spent there, provided no idea, absolutely none, of what mathematics might be as an evolving discipline. It seemed to have to come to a stop: there was this (such and such a construction, object, calculation), which was done like that, which had apparently always been done like that, ever since the Greeks, or almost. Doing math meant progressing from one point, a problem, to another, the solution, which had both been predetermined, and always in the same way: all there was left to discover (and discover quickly) was the path that led there. This is barely even an exaggeration.) (→ § 20)

But I had decided what I wanted, and what I wanted was to understand; that's all. Not to understand this, or that, not just the path from a given hypothesis to a given conclusion, or how best to carry out a calculation, but to understand, period. From a rather idle reading of Descartes, *Timaeus* (one of Plato's dialogues, found among my father's books), a few other bits and pieces of philosophy, as well as the reasoning behind the classification of the sciences (as taught in the "philosophy" lessons at my Lycée), I had come to the conclusion that mathematics was necessary to any understanding of the world. I would have been hard pressed to explain what exactly that meant, other than that it was something desirable, an objective that I could give myself, or else simply an admirable ambition both intellectually and morally. Anachronistically (in personal terms) and rather pompously, I might express it as follows: God, Galileo told us, wrote the universe in the language of mathematics. So to understand and decipher the universe, it was necessary to understand that language. So far so good.



Without really expressing the idea explicitly, I even hoped that there might be indirect benefits for my poetic activities. Just as I'd felt that the critical examination or academic reading of a poem would be a deadly poison when it came to the writing of poetry, as my early discovery of the Surrealists had led me to believe, so the discipline, rigor, and severity of calculation ("Oh severe mathematics!") seemed to me to be a possible mental insulation, even a form of protection (→ § 22). Convinced of the absolute heterogeneity of these two activities, I thought that I had everything to gain from one of them, mathematics, in order to defend the untouchable autonomy of the other, poetry.

There was a further difference, of which I was of course aware, but at the beginning, during the period of pure summery imaginings of my new path, it seemed an advantage, a supplementary benefit to be gained from my decision: if I chose a new subject of study, mathematics, I would have to do it in such a way as to carry it through to professional employment, which did not necessarily have to mean teaching. While poetry was a strictly personal affair, mathematics was recognized by society. I could not only live with it, but also make a living from it.

Now, while the scholarly approach to poetry and even to novels repulsed me (though not intrinsically, which would be a foolish idea, but from the point of view of someone who doesn't only want to read and study), it was even harder for me to envisage (and the study of literature would leave me little choice) having to indulge in such activities as a teacher (the profession I knew most about, because my parents practiced it, as well as being the only one that might leave me with some time for myself). Thus, mathematics



appeared to be an escape route. When I would have to teach it, this would be a neutral activity, as compared with teaching poetry.

Such was the vision, both exalting and reasonable, which guided me. In the fall of 1954, I went back to school, to the Lycée Jacques-Decour in Paris, just by Montmartre (previously the very same Collège Rollin Stéphane Mallarmé taught at), where I entered an upper-level mathematics class, taught by a former college friend of my father's, who had attended the Ecole Normale Supérieure at the same time, named Mr. Durrix, or *Le Dur*, who had agreed to accept the "literary" student lacking in qualifications that I then was. The school was a sort of modest "crammer," which didn't try to compete with the greats, such as Lycées like Saint-Louis, Louis-le-Grand, or Henri-IV, and where the "climate" was not too harsh.

Everything went swimmingly. To begin with.

## 8 But not for long.

But not for long. I got by fairly well during the first year. My "illumination" of the previous summer was still recent, while the novelty of my situation had not yet lost its charm, nor academic rigor its sparkle.

But when I say "fairly well," I mean in math. Because I discovered, with a certain annoyance, that this wasn't all that there was to study. I had suspected as much, because classes of this sort were preparations for the entry exams to the Polytechnique and other prestigious engineering schools, but I hadn't weighed up the terrible implications of this point.

I immediately started having problems with physics. Not only was I extremely clumsy manually, but an even more serious form of clumsiness, this time intellectual, soon paralyzed me entirely. *A priori*, I had nothing against physics (by which I mean the school subject, as it was taught in about 1950); it's just that I had the quite instinctive feeling that it was "secondary" and "derivative" compared with more serious matters (algebra, analysis). So I was not expecting to come up against any real difficulties, just a certain amount of boredom, perhaps, about which I would have to be patient and magnanimous.

But what happened was alarming and unexpected. Of course, the calculations involved in physics were simple enough, once the physical data had been translated into recognizable symbols by someone possessed of the mental ability to calculate ( $\rightarrow$  § 22). But I was almost always incapable of performing this translation correctly. I have stated previously that students were asked to proceed from a starting point, or a given problem, toward a finishing point, the conclusion to be proved. I would have been quite content to make that journey, but when it came to problems dealing with physics, electricity, or optics, as posed at school, I had the exasperating impression that some implicit information that was obvious to everyone (except me!) had been concealed, and I often spent an inordinate length of time confronted with a given problem, incapable of seeing how to tackle it. I rapidly became demoralized.

In such conditions, why did I decide to persevere so long in this same direction? After all, there was no physics on the curriculum during the first year of the certificate of general mathematics at university. (Physics, and mechanics (another horror), lay in store

for mathematicians only later on, when they took their degree.) Because, I think, the sober discipline and regularity of a “prep” school seemed indispensable for someone, like me, who knew nothing, or remembered nothing of what he’d learned at high school.

As the academic year wore on, dissatisfaction preyed upon me. And not only because of my unforeseen difficulties with physics, which were barely compensated for by the fun of chemistry, nor my catastrophic encounter with descriptive geometry, which my inability to draw made horribly dull. Its cause was both more indirect and more serious; more general, too. I did not understand.

I did not understand what I had gone there to understand, which is to say:

a) what math was (both in the absolute sense and in the vague sense of a predicate of existence);

b) or how it helped to understand the world.

I sometimes quizzed *Le Dur* after class (though rather indirectly, as the question I was asking myself was private). I wanted to know what there was afterward, after this year and after the following year of “special” math. But he answered only vaguely.

It seemed to me that the following years would include a large dose of the “same”: integral calculus that was more complicated, differential equations that were more difficult, and so on and so forth, all of which may well have been indispensable tools for the most ambitious formulations of physics, of cosmology as well as for the making of bridges, but if that was all there was to look forward to, then I would never get the answers to my questions. I didn’t see this as clearly as I am now expressing it, but my dissatisfaction was real enough.

My second year was a disaster. The initial impulse, created by

my illumination, had worn off. I stopped forcing myself to make the necessary efforts, which in the end seemed to me to be not that different, fundamentally, from “unseen” translation or prose composition in English, or writing dissertations on Shakespeare and Milton. After scraping by with a passing grade in the “general math” exam, I enrolled in a degree course (and also in the final module for a degree in English, “American Civilization”; after all, I might have to acknowledge my error, give up, and retrace my steps). Amid the dense crowd of students, I went into the Hermite lecture hall for Integral and Differential Calculus, picked out a rather discreet place and, like many of the others, listened to the initial lectures without understanding a word.

### **9 In the month of May this year, the weather is changing gradually,**

In the month of May this year, the weather is changing gradually, becoming less and less like my wintry memories . . . The early hours of the day are still cold, the sky almost numb with chill air, frosty, syrupy, the color of ice, its penetrating gleam reaching me earlier and earlier, despite daylight saving time, even though the curtains of my window are drawn, slipping beneath my defenses: the lamp, the screen in front of me, the silence of the empty courtyard, of an abandoned, flat, motionless town.

Then, with the sun, it soon gets hot: an unpleasant, summery heat, devoid of any lightness. But during the first hours of morning, these two states of being coincide in the air, on either side of the borders of darkness: under the trees, on the smooth, bare stone benches in the Tuileries Garden, just a few inches away from the gravel mixed with sand and swept by the heat, the air remains

clear and cold. It stays so until ten or eleven o'clock, before melting in the sunlight like a between-matinee ice cream, a bonbon in the cinemas of yesteryear, over your fingers.

The Tuileries Garden is being renovated. In one of the main alleys can be read:

Revitalization work on the trees  
for deep and shallow decompacting  
and provision of fertilizer.

A fit of transparency on the part of the parks and gardens authorities has inspired them to inform this garden's "readers" who, like me this morning, come to idle away some time among its pages of chestnut trees and shady avenues, dotted with benches, that they are undertaking tests on "ground sand" (mixed with crushed gravel) in a channel measuring a few feet, with a view to trying out various mixtures before the final choice (this choice will depend on criteria of elasticity, resistance, and, no doubt, cost) of the formula that will be placed beneath pedestrians' soles and dogs' paws.

There are no plans to involve the public in this choice, in which, I fear, criteria of color, fineness, texture, and even origin will play no part. Notice boards, which I have never seen anyone read, provide written indications accompanied by figures that are hard to interpret and barely visible, just like those that can be seen on any street, at the foot of a building, or a plaque over the sewers, meant for maintenance teams or the fire brigade, excavation companies or pest controllers, how should I know?

Trail #9

White quartzite sand

Trail #6

Rolled Oise River sand

Trail #5

Off-white cement sand, milk-white ballast

Trail #3

0/6 Seine sand 0/4 crushed

I admire them all.

The sun, helped by a little wind, runs glimmers over the little waves on the surface of the ornamental pond. The ducks swim around, just by the edge. I suppose that, on the one hand, they are thus better able to pick up any edible offerings from visitors, while on the other, they want to stay out of reach of the carp, which make almost dolphinlike leaps and look decidedly mean. I can certainly see the ducks' point.

Totally immersed in coolness, and facing the rippling glints in the pond (→ § 24), I begin a prospective rumination: to say that I am thinking would be an exaggeration; the environment is hardly favorable for that. I have turned off the screen of my Macintosh LC, left my room, walked unhurriedly along rue de Clichy, by the Trinité, the Opera, and Place Vendôme, then wondered how to proceed, which way to choose, tomorrow, so as to progress in this shaking-up of memories, recollections, in this description, this explanation, this elucidation.



What is now out of reach, for certain, is a renewal, a new departure, a starting all over. What I am trying to understand, what I turn this way and that in my thoughts, is not the unknown, but the new, the never seen before. I try hard not to discover, invent, or prove. I search around in what is bygone, irreversible; in oblivion.

Dante's *proem* comes to my mind, with its infinitely seductive opening lines:

*“In quella parte des libro della mia memoria, dinanzi  
a la quale poco si potrebbe leggere si trova une rubrica,  
la qual dice: INCIPIT VITA NOVA.”*

I had found this word: Mathematics. It had offered me, I thought, a new life. Thanks to it, thanks to them, a *vita nova* was going to begin, opening out for me. I had then concluded that it was just an illusion.

I looked, hunched up against the wall of the lecture hall, not toward the board, but toward the wintry exterior being invaded by another illusion, the virtual image of light, faces, hazy, steamy, suspended in frozen air. How to be in another place? And where? And yet, it really was another life that I was being given. Of course, as ever, I was not to realize that fact and would recognize it only later, when I knew that it had once been; and now no longer was.



## Interpolations in Chapter 1

### 10 (§ 1) **evade the vigilance of the college janitor**

His name was Paul (?) Belgodère. And he was just called “Belgodère” by us, his “flock”; so that “Belgodère” quite easily became “belgodère,” without its capital, in other words, no longer so much a proper noun naming a given individual than a common noun describing a symbol of administrative power; in other words, thus, for his individualistic or political adversaries (generally communists), he was the main obstacle to the expression of their undeniable freedom (for some), or else (for others) the symbol of a false neutrality, seen as being “formal,” state-controlled, superficially independent but, deep-down, secretly in league with the Bourgeoisie.

He played both roles with zeal and enthusiasm. But his reactions were not, strictly speaking, political. He was above all the incarnation of the building in his charge. He felt responsible for the class schedule, the heating, the lightbulbs, and the cleanliness of the toilets. “I am the only math graduate,” he once told us proudly, waxing confidential (we were already old and familiar enemies), “who cleans the toilets.” We didn’t confront him with the example of those who were performing similar tasks in the armed forces of the Republic (at the time, world famous for its exploitation of native talent), because they were not volunteers.

But he now had his hands full, for the “Bourbaki” generation was also a turbulent one, and its turbulence was, I believe, conditioned arith-

metically. The IHP was never less than overwhelming, but “belgodère,” according to his “SAP” (or “spontaneous administrative philosophy”), would have preferred students who were virtually immaterial, colorless, odorless, and tasteless; in other words, when on the premises they should be like children according to the Victorian adage, “seen but not heard.”

So, his name had become no more of a proper noun than “choquet.” But as he was unprotected by professorial rank, he did not escape our hostility or insolence. He spent a large amount of his time watching out for our transgressions, then responding by unfairly throwing us out of unused rooms before locking the door, thus preventing us from benefiting from the calm of their blackboards and chalk, far from the uproar of the single, overcrowded “Common Room,” which was totally unsuited to such a large mass of students; or else, like Cerberus, by watching over the doorway of the library, so as to restrict its access to the teaching staff and researchers. There was nothing exceptional about all this: it was simply a preview of what would soon be the common fate of almost all universities (and still was the case for Paris-X Nanterre, when I left it in 1991), with the simple difference that, after May ’68, there would be no more “belgodères” anywhere to enforce and maintain a semblance of order.

At the most heated moments of their protests, some even took their inspiration from current events and adopted a characteristic rallying cry, calling for the “de-belgodérisation of the IHP.”

These must have been difficult times for him. However, the sudden departure of hordes of barbarians for the greener fields of the “Jussieu” campus didn’t seem to give him real serenity. Over time, toward the last years of his life (he never left the Institute) his old hostility, which had always been for him “generic” or impersonal, gave way to a sort of gruff gratitude to those of us who still frequented those sacred premises, in

part but not entirely because we had become respectable teachers. He was only too pleased to unlock the classrooms for us, check that the boards were clean, and that chalk and erasers were available. But we felt that he was always on the verge of saying: “How wearisome to me, the wastes of IHP!”

# 11 (§ 2) **Apparently, a clean slate had just been made of the past of mathematics**

For many, after thinking things through to a greater or lesser degree, “Bourbakism” seemed (wrongly, of course, in the end, but then, in order to avoid such an interpretation, it would have been necessary to be wiser (and it must be said that some of our masters’ “exaggerations,” for example the famous cry of Jean Dieudonné—hopping like a hammer-thrower at the Olympics (as the possibly apocryphal legend has it) with all his bulky height upon the podium at the Congress of the Association of Math Teachers, yelling out a thunderous “Down with Euclid!”—made such distortions quite likely)), seemed, as I was saying, to wreck the entire edifice of existing mathematics, so as to rebuild it anew. “Down with the world, I’ll make it more beautiful!”

And, of course, we couldn’t avoid being struck by the analogy with another “clean-slate theory,” as practiced by revolutionaries and expressed in the lines of “The Internationale”: “And at last ends the age of cant . . . We’ll change henceforth the old tradition.” On the cleansed slate of the old tradition of calculation and deduction, the mathematical world, just like the (prefigured) “real” world, was about to start all over again. It was an exhilarating prospect and, above all, seemed far less distant than the other, political, version.

Thus, according to this interpretation, it appeared that—and the dismay of the “old ones” in the lecture hall, or the perplexed expressions, reticence, and even sarcasm of some mathematicians of previous generations confirmed this assumption amply—choosing this “revolutionary” path in mathematics immediately placed us in a sort of fast lane (though a successor to the Pharaohs had once, so it’s said, tried to warn mankind that there was no such thing in this domain). We would go farther and faster, uncover great secrets more easily, and perhaps discover, in some as-yet unlit realm of the paradise of sets, the heaven reserved for mathematicians from which, to quote Cantor quoting Hilbert, “none could [ever] dislodge us,” and whose terrain would be rigorously mapped by the Archangel Bourbaki. “We are nothing, let us be everything!”

As far as I was concerned, a further parallel needed to be drawn, which was also fallacious, as I was to find out, but only much later. And it seemed absolutely explicit: the (political) revolution and the revolutionary spirit also had their analogies in poetry, as had been clearly stated by the Surrealist movement.

In poetry too the old world had been torn down. Freedom had triumphed. The modernist enlightenment had, after the revolutions at the end of the previous century, obliterated the dated, reactionary forms of the old tradition. This is an idea that still can be found, in burlesque form, in the now long-forgotten theory of the “Revolution in PL (poetic language)” formulated by Julia Kristeva. Hence this obvious ratio: free verse is to the axioms of set theory what Euclidean geometry is to the alexandrine.

(I won’t conceal the fact that a clear contradiction soon appeared in this beautiful triangular perspective of revolution-mathematics-poetry. For, at that very moment, Aragon, whose politico-poetic authority was great in my circle, advocated a return to traditional verse (having once again, as early as 1939, gone back to the old dodeca-syllable in particu-

lar). His command was to use only measures that were “truly rhythmic and truly counted” (as Éluard wrote, toward the end of his life), while he himself adopted Couéism. His alexandrines were certainly post-Rimbaud and post-Apollinaire, but—still! I had no idea how to disentangle myself from such “theoretical” difficulties, without renouncing my exaggerated demands for coherency.)

## 12 (§ 3) “alpha point alpha point alpha alpha point point point”

This expression is merely the incomprehensible form (because of its unfamiliarity) of what is in fact quite a simple object. It is a representation of an abstraction, an abstraction known as a “tree.” This formal “tree” object does not in fact have a trunk, just the nodes of branches (noted as points) and branches (segments of straight lines) finishing at other points (the nodes of possible branches, but without branches, or void of branches), which are the “leaves.” The expression cited above is a tree in this particular sense of the word, and its “geometric” representation would be:

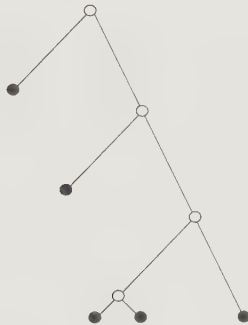


Fig. 2

Note that the convention, shared by linguists, computer scientists, and the few mathematicians interested in such matters, has it that the tree is pointed downward, with its roots in the air: in other words, upside down. How odd!

If we consider the “points” in the notation as full, indecomposable singularities, about which we need to know nothing more than their isolatable singularity, which makes them indiscernible, the tree can be interpreted “algebraically” as superimposed groups, with the symbol of a group being “alpha.” Thus, “alpha point point” stands for a group made up of two “points,” which is a particularly simple tree with two branches, two leaves (called “points”), and one node, called “alpha.”

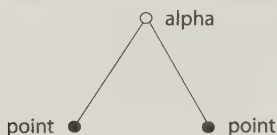


Fig. 3

We can then group together the groups and overlay them, while always respecting the condition of having just one mode of grouping, always by twos, always with the same “name.” Which means taking the leaves of the elementary tree above as the nodes of a new tree:

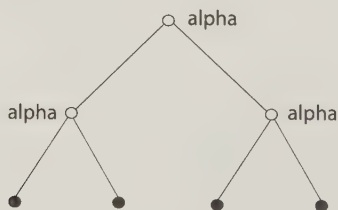


Fig. 4

The category of tree thus obtained, of which the tree in question is an example, is that of “binary trees.” When it comes to the interpretation of groupings, we make use of “bracketing”; in this case, “binary bracketing.” We may place the points or the groups that have already been bracketed between fresh brackets. So the series of symbols

**“alpha point alpha point alpha alpha point point point”**

can be written, in bracket form, as follows:

(. (. ((.)).)))

The method of transcription, known as “Polish notation” is more “economical” in its symbols (and in its dimensions; it isn’t “planar,” as is its geometric representation, but linear, just like ordinary writing). Only the “opening brackets” are noted. Their position of closure is then determined individually. We could also envisage ternary, or even n-ary, bracketing (and trees), with several sorts of point, several ways to make groups, several names for branches . . .

If the geometry of an arborescence is interpreted, by projecting it onto paper, as in cartography, its transcription as alphas and points then appears to be strictly linear and strictly oriented, a translation with no means of returning to, or even memory of, the figure of a tree. It can thus be seen as a sort of analogy for the linear approach to writing I have adopted in this book, which inflicts the partly arborescent cartography of its narration upon the demands of a printed object and on its reading. (Though one difference is that the geometry of trees in no case allows the returns backward that are permitted by prose: no branch of a tree ever goes back to its point of departure to graft itself there; there are no “loops.”)



**13 (§ 3) another door, lower down still, this time to the left of the blackboard**

On a Saturday morning of this same month, I suddenly had the desire to see once more the places I was evoking in this chapter. I walked down rue d'Amsterdam to the Gare Saint-Lazare, took the 27 bus with its double carriages (but not, alas, double decks), got on at the front, sat down on one of the two three-place seats that face each other at the front of the carriage (the seats closest to the door, and also, of the three, the seat closest to the door) and got off on rue Gay-Lussac, at the most favorable stop, just opposite the Hispanic Institute, on the other side of the road.

But I had made the journey in vain (which is why I am now avenging myself for this setback by introducing this interpolation). It was impossible to go into the IHP. All of the gates were locked.

I slowly walked around the building, taking rue Pierre-et-Marie-Curie then rue d'Ulm (examining as I went the state of affairs at the old café, "Plantin" (thriving)). The access ramp for cars was open, because of construction work, and I could have gone in that way, but there would have been no point, because the IHP itself was quite clearly closed.

I must insist on the fact that I made this attempt to return to the "scene of the crime" only after having described it (I term all such pilgrimages "returns to the scene of the crime" because they are nearly always accompanied by a vague sensation of guilt, as though I were always expecting to be contradicted by the present, while at the same feeling responsible for any inconsistencies in my memory).

As scrupulously as possible, I abide by the commitment to veracity I made at the start of this enterprise (and which I have respected in the two volumes (branches) that have already been published). But the truth

of a memory is not the memory's truthful conformity with the things being remembered.

I went back on a weekday. Everything was open, but empty, with a ghostly absence of activity. Nevertheless, I went to the far end of the main corridor (the classrooms to the left have now disappeared, and been replaced by offices). I opened the door of the lecture hall. The control desk for the blackboard was on the right (but this could be a relatively recent modification). The rest offered no surprises.

#### 14 (§ 4) a book is the autobiography of its title

If a book is the autobiography of its title, then what is specific about this one: “**Mathematics:**”, which, with casual aplomb, quite clearly covers more ground than it seems to admit? Let us accept the analogy, as proposed in our aphorism derived from Stein, between the unfurling development of a book, starting from its name, or title, and an autobiographical narrative. If I see *David Copperfield* on the cover of a novel, I naturally expect that it will be the story of David Copperfield's life. And, as this book is identifiable as being what it is, because of its name, and has no other material existence, then it is indeed this particular “David Copperfield,” whose name appears in the title, whose life will be narrated in the book. Let us also suppose, metaphorically, that mathematics can be given a similar status (there are two differences which I am neglecting: in the case of Dickens's novel, the name David Copperfield is not followed by a colon, nor is it trapped between two “”), so the question remains: what sort of life of mathematics will this be?

It won't, or not primarily, be about the life of mathematics in my own life. Nor will it be a sub-story of my own story, or of that part of my

story (in the broadest sense) that covers my discovery of a certain idea of mathematics, nor the influence this discovery had on the circumstances of my life. It will only concern those matters that, under these circumstances, deserve mention in terms of the enterprise which I call the **Project**. Primarily, it is about this **Project**.

This book, which is branch three of the “**great fire of London**,” is part of what “**The Great Fire of London**” is, in part (and only in part, to be precise, because that isn’t all it is; and it is definitely not primarily that, or at least not directly)—of what conforms to its title, in other words a biography of what I call the **Project** (or its autobiography, if you prefer, but only in the banal sense of its being my project, examined and described by me).

There is, thus, an interlocking, an extension, an *embedding*: mathematics enters, penetrates, dominates, then diminishes in my life, but primarily in terms of how it acts (penetrates, provisionally dominates, then diminishes) in the conception and application of the **Project**. And the tale of this embedding requires and justifies, supposing of course that any of this can really be justifiable, the embedding of a branch entitled “**Mathematics:**” among the  $x$  programmed branches of a narrative related to the **Project** (and having a partial relationship with it “biographically”). It tells of its premises (and premisses).

This means two things: firstly, that the title of this branch is not simply Mathematics but “**Mathematics:**”, that is to say, existing in a situation of dependence and “embeddedness” (to coin a noun) with a title not its own; this dependency being expressed and signified by the quotation marks, and the “embeddedness” evoked by the addition of a punctuation mark!;

and, secondly, this relationship of dependency and embeddedness quite clearly refers to the relationship of dependency and embeddedness

that pertains between “**The Great Fire of London**” (the overall title of what I am writing) and **The Great Fire of London**, the novel that I have not written, and which was stillborn along with the **Project**. (→ branches one and two; especially branch one) (Added in 1995: I should like to point out that, for reasons beyond my control (an insurmountable block lasting over a year), this volume includes only the first part of the third branch.)

**15 (§ 4) images entwined around one another appeared in response to a narrative decision**

All narrative decisions, all beginnings of all tales, necessarily set the memory in motion: in a disorderly motion, an imprecise proliferation, an orgy, not even with images, but bits and pieces of images. Almost instantly, there is a sort of explosion of time. (From the magma of the beginnings of images that rises at the moment that the memories I’ve called up in order to write this interpolation are put in motion, I carve out a metaphor: “explosion of time.” In condensed language, it attempts to grasp a principle of transition. An assault of memories provides a time: a chaotic time, yet past. A line of poetry has occurred to me (only just occurred to me) to depict it: “*Explosions of time, fruits always ripe for the memory/*”).

Each voluntary attempt to resuscitate the past either runs up against a gray limpness, or must run up against such an “explosion.” The extraction of images and the placing of sentences, which provide narrative visibility to the images associated with one’s present-interior, do not simply master, compress, control, and slow these down. Freeze-framing, or the writing of sentences, attempts to tame the disheveled entangling of memories, to make them exploitable for a narrative, to convert them into

an entwining of stable, defined pictions. I am inventing a memory game (in this case, a deliberate one).

In this branch, as in the two preceding ones, I am trying to remain absolutely faithful to this approach to memory; though this approach can, perhaps, be only very imperfectly faithful to the memories themselves: even the slightest attention paid to the process of observing the phenomenon of recollection has shown me that the investigative apparatus that I have set about using—that is to say the conscious gaze, its insistence, its fixedness and slowness, aided by the tools of language—is even less separable from its object than “quantum” nature is from physical matter, from protocols of measurement or from the internal logic of its definition. (Which is not to say that I suppose that my observations have the slightest physical influence whatsoever on the system being observed by these memories. Language is the observational apparatus of the memory. Through it, I define myself as its local observer.)

But the functional strategy of this memory game is in deliberate opposition to the one I used in branch two, whose title is **The Loop**. There, I presented in prose a sequence of memory-images, which were local memory games restricted only by the chronological limits providing the point of departure that must precede the construction of any narrative, and which in turn quite simply followed them, more or less sequentially.

The approach in this particular branch is the opposite. I am intentionally seeking memory-images suited to my subject, as well as bundles of clearly correlated images (both semantically and chronologically) so as to exploit them in the advancement of an ongoing unfurling: that of “**the great fire of London**” in its entirety, which must satisfy a definition that has been decided upon but remains implicit, while also satisfying, branch after branch, a particular aspect of that definition.

It follows that I do not hesitate to prune back from the arborescence of images that answer my call any overgrowth that exceeds my intentions. I never modify them; that would be contrary to the self-imposed ethics of my book. But I do simplify them. I color them with a meaning that might be either consciously anachronistic, or at least willing to run that risk, which is introduced into them in the future perfect tense, moving them forward into the future of a narrative in which they'll meet other images, thus forming what I call an entwining.

16 (§ 5) **the rectangles, squares, and diagonals sketched out by Socrates in *Meno***

*(Enter Mr. Meno, Socrates, and the Boy.)*

Mr. Meno (M): Hey you, come here.

Socrates (S): Reassure me about one thing. Does he speak good Greek?

M: Yes, of course. He was born in my house.

The Boy (B.): *Efkharisto poli. Touristiki to phageton.*

S: Pay careful attention. Watch out and see if I teach him anything, and then if he anamnesizes.

M: I'll watch out.

S: Tell me, boy, do you know that this is a surface with four sides?

B: Yes, I do.

S: And do you know that, upon this surface, all four of its sides are equal? And that their lengths have the same virtue, and are of the same measure and count? Do you know that?

B: Perhaps.



S: And that the lines which pass through the middle are also equal?

B: Yes, Socrates.

S: Couldn't such a surface be larger, or else smaller? Speak calmly.

B: I am young, it is true, but from well-born souls; worth does not await the number of years. I would answer: yes.

S: If this side was two feet long, and this side too, how many feet would that make in all?

B: ?

S: I'll rephrase that. If there were two feet in that direction, and only one in this direction, wouldn't the surface total one times two feet?

B: No doubt.

S: But given that here we also have two feet, doesn't that make, let's say, two times two feet?

B: Your words are gold, Socrates.

S: And how much does two times two make? Calculate, then tell me.

B: I'll let you know, four paces from here.

S: And couldn't we draw a surface twice the size, but similar, with all of its sides equal, just like this one?

B: Of course.

S: And how many feet would that make?

B: Eight.

S: Try and tell me how long each of the sides would be. The sides of this surface measure two feet. So how long will the sides of the double surface be?

B: Double.

S: Note, Meno, that I am teaching him nothing, I am simply asking him questions. At the moment, he thinks he knows the length of the sides of a surface of eight feet, does he not?



M: He does indeed.

S: He thinks so. But does he know?

M: No, he doesn't. He **believes** that this line will be twice as long as the other.

S: Very good, now you're going to see him start to anamnesize, to remember things in order, as they should be recalled.

So, boy, you say that a double side will produce a double surface?

B: I do.

S: I am talking about a surface like this one, not a surface that is long in one direction and short in the other, like that one, but instead a surface which is equal in all directions, and totaling eight feet. Do you still persist?

B: Yes, I persist. Anyone else but me would have trembled in fear at the very sound of your name; the laurels that I see crowning your head in such profusion seem to have written upon them my fated downfall. I am foolhardy enough to strive against your ever-victorious arm. But, as my heart is great enough, I shall have that strength.

S: I admire your courage, and pity your youth. Will we have a double line, if we add on another one of the same length?

B: We will, that I must admit.

S: And, from this line, will we not obtain a surface of eight feet, made of four sides of the same length? Let us, then, draw those four lines, using the first one as our model. Is it not like this that we shall obtain a surface of eight feet?

B: Um!

S: But does not this surface contain four surfaces such as this, all of them equal to the first one?

B: That I cannot deny.

S: So what size is it? Is it not four times larger?

B: (*He remains silent.*)

S: Is twice the same as four times?

B: By Zeus, no!

S: So what is it, then?

B: *Tetraplasion*.

S: Thus, doubling the sides does not give as a double surface, but a quadruple one?

B: (*He remains silent.*)

S: And four times four makes sixteen, does it not?

B: Pierced to the very heart / By an attack as unexpected as it is lethal /  
I remain still, my stricken soul / Yields to this killing blow.

...

The role we had been given was not so different, in fact, from the one entrusted to the “boy” by Socrates in this dialogue. The apparent simplicity and the “triviality” of the surfaces of the sets as presented concealed a profound truth. A “famous” error committed by Lebesgue, who wrongly supposed that “an image made from the application of an intersection is the intersection of the images,” acted as a parable. Without set theory, we were in danger of falling into the same sort of error as well, or even of committing far worse ones. If, like the Boy in the Platonic parable, we allowed ourselves to be guided by our intuition, catastrophe would ensue. We would imagine that we possessed knowledge, but this knowledge—our tiny, conscious knowledge—would be a mere illusion, simply the opinions handed down by the mathematicians of the past. In reality, of course, we knew that. But we did not know that we knew.

The knowledge of sets was within us. It is the most fundamental mathematical knowledge. But we had to go and seek it out inside ourselves, just as the Boy, under Socrates's careful guidance, came across the concealed idea of the "diagonal," by way of anamnesis and recollection.

### 17 (§ 5) **many of them underwent a genuine conversion**

It will be necessary here to make a distinction, crude but nonetheless useful, between what might be called different generations. The Bourbakists, founding members of the group, apostles of a new mathematical religion, had set up quite an exhilarating enterprise: reconstructing the entire edifice of mathematics by drawing on (as they put it) a "single source": the axioms of set theory. This group constituted the second generation (since, arbitrarily, I've assigned all the "non-Bourbakist" mathematicians to the "first generation," made up of "graybeards"; a generation that seemed dated (for a fanatic Bourbakist) and archaic).

But Bourbaki, that "collective mathematician," as Raymond Queneau put it, also had a good knowledge of the current state of mathematics at the time when his *Treatise* was being composed; with, of course, a few "gaps": for example, probability, which was considered to be just an "applied" brand of measure theory; and logic, especially logic, which was made almost a pariah because of (so it was rumored) the premature death of Herbrand, who, in the generation of founders, *Normaliens* to a man, had studied under Hilbert, and had thus been associated with his meteoric rise; in sum, logic had died in a climbing accident along with Herbrand. Thus, the Bourbakists were clearly aware of the distance between the "reality" of mathematics and the ideal presentation of an axiomatization, even a solidly constructed one such as theirs.

(But they do not seem to have been conscious, at least not during the period I am discussing, of an even more serious problem with their project: the architecture of the Treatise was in fact founded on the idea of sets; not just on the rigorous axiomatization of this notion, but actually on the idea, described by Bourbaki as “naïve,” of a collection of simple abstract objects that had no intuitive properties other than those resulting from a relationship of inclusion connecting two types of elementary objects: members and sets. Hence the extraordinary difficulty in altering the Treatise’s architecture, and above all the virtual impossibility of admitting the likelihood, and maybe even of conceiving the possibility, that any upheavals in the “foundations” of the edifice might subsequently become necessary.) (I came across the same sort of difficulty in the pursuit of the chimera of my **Project**; and this impossibility resulted in part from its “Bourbakist” inspiration.) (It’s probably also for this reason that, today, I am absolutely allergic to establishing the various stages of this book in advance.)

The next generation provided their immediate followers, those who had been converted, and as is always the case with converts, they had a strong tendency toward fanaticism. This third generation encountered Bourbakism in the lecture halls of the Institut Henri Poincaré (while Poincaré must have been spinning in his grave) and then, little by little, in all the scientific universities in France, as the wave of modernism gradually invaded them. Still, during their pre-university studies, this generation of mathematicians must have been introduced to a vision of mathematics, at a far more elementary level perhaps, but already solidly formed, which was quite different from Bourbaki’s; and, even though they might now reject the older view virulently, they could not ignore the fact that the version they had subsequently accepted wasn’t the only one that existed, and that one had indeed replaced the other (or perhaps more than just a single “other,” in fact).

Finally, the fourth generation arrived, made up of the followers of the followers, and instructed by those followers. In all situations of this sort, the followers of the followers have no idea of what motivated the founding fathers, nor of the residues of ancient knowledge that their immediate predecessors still possess. They think they know all that there is to be known, right from the word go. They think that all they have to do is continue, and progress farther along a line that has already been traced out in its entirety. All they have in mind is this idea of the future. They know almost nothing about their discipline's past, that inverse future which is quite as necessary as the other when it comes to gaining an understanding. They were the mathematicians who invaded the schools and colleges of the 1960s, and the majority of them, of course, quite simply contented themselves with the axiomatic certitudes they had acquired.

In poetry, relatively speaking, the Surrealist heritage played a similar role to that of Bourbakism, and it still does, even among those who think they have freed themselves from it.

18 (§ 6) **So, I said to myself: I'll be a mathematician!**

This is how I recall it (and I've often repeated that phrase to myself, as if it were the simple, unchanged reconstitution of an undisputable memory), "one day, I said to myself: **I'll be a mathematician!**" In the constantly and unconsciously revised autobiographical constructions that we all indulge in, which are hardly more stable than the handing down of genealogical information in a preliterate society, evocations of such so-called decisive moments become enriched by new narrative details year after year, until they turn into a sort of tale.

If I try my utmost to uncover the workings of this particular tale, and follow the hidden path behind the “idea” that suddenly occurred to me of “being a mathematician,” I must recognize the existence inside it of several different steps, and a small number of speculative “stations,” the last of which were rapidly traversed during the first days of the summer of 1952, the final result being a complete change in my perspective on life.

By dropping my preparations for the literary entrance exam to the ENS, I had already safeguarded the absolute independence of my poetic activities from academic critical “dissection” (an old post-romantic position, rejuvenated by the Surrealists and which I had adopted, I thought, spontaneously). I then began an English degree, in which the struggle with a foreign language imposed a new distance from poetry. I instinctively felt this to be salutary.

But why stick to just one language? My familiar demon, inquisitive intellectual megalomania, suggested Russian, which wasn’t really a surprising choice at the time, given the recent end of the war, and the quite reasonable pretext that it would provide my future qualifications with an “added value.” Additionally, this language’s distance was far greater; both because English had been part of my world ever since childhood, and because, in the case of Russian, there was also its aural, accentual, morphological (eight cases!), and syntactic exoticism (its astonishing “system” of verbs, along with its mysterious opposition of a perfective and imperfective aspect in each verbal idea), as well as the very great charm of its singular script.

(As it was an “alphabetical” system, no great effort was required to master it visually, while a few Greco-Roman similarities among its letters put an even greater emphasis on the originality of its “ui” for example;



but most of all, undeniably, there was the impressive array of alveolar fricatives. I couldn't read the word "chtchi" (cabbage soup) without seeing and hearing the distant, vast purring of the Volga, which haunts Donskoy's films and Gorky's *Klim Samgin*.)

I'd hardly "swallowed" one year of Russian before my ever-present demon, who always tired so quickly of the indispensable efforts required for the realization of any one of its marvelous and demoniacal programs, and who was thus more than ready to explain away the most pathetic desertions as being in fact utterly audacious (he had a quote by Villiers de l'Isle-Adam at his disposal: "Why realize your dreams? They're so beautiful"; plus the "Gertrude Stein" version too: "If it can be done why do it"), pointed out that there are several Slavic languages other than Russian, an entire family in fact, and it would be an appreciable gain in socially useful knowledge, as well as originality, if I took up all of them. And so, that fateful early summer, I at once acquired Antoine Meillet's Polish grammar.

19 (§ 18 continued) **But, language studies at the time touched on linguistics only as "history"**

But, language studies at the time touched on linguistics only as "history," and even then under the wing of a discipline called philology—for example, an English degree included a certificate bearing this name, qualifying for which involved our initiation, not without tears, into the "Old English" of *Beowulf* (and we rapidly came to curse the miracle that, around 1700, had *in extremis* saved the sole manuscript of the poem from a fire in Oxford's Bodleian Library (what terrible sacrilege . . . ! since the flames had merely licked it, then stopped before consuming it)).



We (rapidly and succinctly, just enough to whet my demon's appetite) learned that Old English was a Germanic language and that its ancestors had come from the pool of a strange and hypothetical "Common Germanic," which in turn was the belated offspring of the highly mysterious "Indo-European." Chance would have it that the author of my Polish grammar, the pages of which were hardly cut before they seemed fairly dull, had also taken an interest in this Germanic language and, most importantly of all, had written an *Introduction to the Comparative Study of the Indo-European Languages*. This title, which was simultaneously sober, majestic, and reassuring (it was, after all, an "introduction"), appealed to me. I wasted no time getting hold of a copy.

I opened it and a bewitching universe arose before my eyes. How distant and trivial the annoying details of English prose composition now seemed: the vocabulary lists to be memorized, the idiomatic expressions, the "false friends" . . . stuff and nonsense! An immense world now opened out in front of me, over which I glided with ease, perched on the flying carpet of the rigorous philological prose of the great Meillet, a successor of Ferdinand de Saussure and Michel Bréal: the dizzy heights of Hittite; the marvelously subtle distinctions between Tokkarian A and Tokkarian B! The ruins of languages that emerged glimmering from the sands of a desert in Mongolia before being recognized as cousins of Greek, Welsh, Latin, and Albanian! Prudently, I glanced through the main chapters without going into the technical details (which looked arduous), but I read and reread again and again the general overview: the introduction to the "introduction," a description of this landscape of a thousand and one linguistic nights. Ah, beautiful dead languages, my parents, how much I would have liked to understand you all!

In such conditions, it may seem strange that I didn't devote myself to mastering one by one the languages, dead or alive, of this large family (this has been one of my regrets). I don't know exactly why, but it was not to be. I would probably have had to make a huge effort; I was probably not ready at the time to undertake such an effort; and above all I was not driven by any real need: I am not a "natural" polyglot, and I would have had to compensate for my lack of facility in learning with hard work. Whatever the truth, it took me just one afternoon to change course abruptly, and replace Indo-European with mathematics.

The reasonable reason for this change seems entirely clear to me. Over the years, I have thoroughly "polished" this tale in my mind. It comes in two phases:

– firstly, what "really" attracted me to Indo-European, as well as to English, Polish, and Russian philology, wasn't the seductive variety of linguistic forms, or the infinitely picturesque accidents that fill the histories of words and dialects, but rather the fact that these obey laws that can be rigorously described, and that these laws, such as Grimm's Law in Germanic philology, or the principles of Slavic palatalization, which lie behind all those wonderful alveolar fricatives in Russia and the Auvergne, promised to submit the irresistible and eternal movement of languages no longer to mere chance, but to something that closely resembled calculation;

– and that, secondly, and consequently, the noblest aspect of linguistics (and if I had been familiar with Troubetzkoy's phonology and with Jakobson, this conclusion would have been even more obvious) was its power of deduction—but that there remained something even nobler, which was the terrain of pure deduction, in other words, mathematics. And that it is why I absolutely had to become a mathematician.

**20 (§ 7) all there was left to discover (and discover quickly) was the path that led there. This is barely even an exaggeration.)**

This rather puerile idea comes essentially from prep school. Rather like in sports coaching, in overheated intellectual climates such as these, before entrance exams to variously prestigious colleges, the students are given problems that must be solved, when the time comes, more quickly and ingeniously than by the other candidates (the rivals for those much sought-after places at the Polytechnique, Les Mines, or other Ecoles Normales Supérieures of varied stripe), and their exceedingly difficult nature inevitably created (the present tense would also apply here, the situation having barely changed) a feeling of admiration for those who succeeded best. In fact, this marked young minds indelibly for the rest of their existences.

The consequences of this need to proceed simply, though of course taking the necessary pains and showing your work, from situation A (what has been acquired and is now known) to situation B (the theorem to be proved, whose nature is already known, and which has even been described) were (are) not limited to its being a basic contradiction of the very nature of mathematical research, as I have already remarked. When faced with real, living mathematics, these brilliant candidates, now aspiring mathematicians, simply had to abandon this notion as quickly as possible. But when it came to the mathematics of discovery, their old ideas remained, only more or less unconsciously—occasionally just slightly—transposed or disguised. We can blame the inspiration of the famous dictum, repeated *ad nauseam* by the most eminent Bourbakists then recycled by their disciples: “The honor of mathematicians is to prove theorems.”

This rather medieval ethical concept, evoking knights, tournaments, and duels (in the “Alexandre Dumas” sense of the word), is far from being the least important element in this case. For example, it implies that those mathematicians who do not prove theorems, or only rather insignificant theorems, which are too easy and have not resisted their predecessors’ efforts long enough to be considered “real” theorems, have little in the way of mathematical honor, or even have no honor at all ( $\rightarrow$  Bif. A).

This would surely have warmed the heart of the inventor of the zero, supposing that he would have been able to understand such a “thought” at all, which seems unlikely.

An associated idea, which is particularly influential in the “French School,” was that a “mathematical champion” always dwelled alone with his creations. His value was purely individual. You are alone when you undergo the trials of initiation triumphantly, and alone when you attain mathematical glory for the “result” of your research (there are no collective submissions to the entrance exam for the Polytechnique).

Finally, this same notion justified the oddity (at least to my mind) of the adoption, unanimous, on the parts of teachers and students both, of a strict hierarchy by which to rank the various branches of mathematics: in elementary terms, awarding geometry an intrinsic superiority to algebra, while arithmetic is left to one side as being unclassifiable, like a mysterious sort of poetry.

21 (§ 20 continued) **It is in the light of the above that I shall attempt to interpret this statement**

It is in the light of the above that I shall attempt to interpret another statement, which is often cited with great gravitas by Bourbakists, and at-

tributed to Dirichlet: “The great mathematicians have always been those who have succeeded in replacing calculations with ideas.” (Or so goes my current recollection.) There is nothing offensive in this sentence at first sight, and it can even seem to be a truism. But, if we leave to one side the spirit in which Dirichlet first pronounced his remark, and the particular circumstances surrounding it, which are now of purely historic interest, its insistent and anachronistic use in the present day displays a certain scorn for arithmetic (and I am not thinking here of numeric or automatic calculation, nor the clichéd opposition between pure and applied mathematics), and thus a clear devalorization of algebra.

It expresses the deep conviction that anything mechanical, or that can be mechanized, has no intrinsic value, and has in fact no real mathematical meaning. It overlooks the fact that many ideas are born from arithmetic, and that while it has no intention of substituting itself for mathematics, it instead accompanies it, providing it with greater strength thanks to new modes of calculation. This insistence also “overlooks” the fact that, even more significantly, arithmetic possesses the therapeutic power of showing that many apparently profound, original, worthy ideas are merely dreams, ghosts, and illusions. In reality, it would be possible to defend the thesis that all mathematical ideas are in the end “calculable.”

This disdain for arithmetic and algebra also results in a certain reticence (to put it mildly) in the mathematical world—inhabited by working mathematicians, whose suffrages are essential if a new theory, or new viewpoint concerning the very objects of their expertise, is to be accepted (such theories and viewpoints being always confronted by the crucial question: “What is this for?”)—when it comes to the formal, arithmetical aspects of logic, for example “predicate calculus,” or more generally anything that can be described, in clearly pejorative terms, as being “syn-

tactic,” as opposed to the sole quality that has any right to nobility, which is the “semantic.”

Working mathematicians have long found particularly repugnant the idea that the process of proof, which is the very essence of what, since the Greeks (without any modification, or so it was thought) has constituted the irreducible originality of mathematics, could itself be made calculatory;

except in a strictly subordinate, limited way: helping to defend mathematics against uncertainty, and against all those obscure paradoxes from the beginning of the twentieth century that posed the embarrassing but gradually more and more secondary question of “foundations.”

(Thus, as a naïve reflection of this intimate conviction, the introductory chapter to the book on Set Theory in Bourbaki’s *Treatise* (which came in for a number of sarcastic comments from logicians) attempted to dispose once and for all of any such secondary questions, which were rejected as being outdated, thanks to a few disdainful, serene sentences in the majestic presentation of the motives behind the entire enterprise.)

**22 (§ 7 & § 8) the discipline, rigor, and severity of calculation seemed to me to be a possible mental insulation, and even a protection (for someone possessed of the mental ability to calculate)**

Elementary algebra had always appealed to me, and this is the subject I was looking forward to most of all in my “crammer.” It was a game, with clearly defined rules, which was played using symbols, which were as close as possible to numbers, except that they replaced them. I liked “remarkable identities,” I loved Pascal’s triangle, the coefficients in Newton’s binomial theorem, and the fascinating “sums” that can be deduced



from them by way of not especially exotic manipulations. Third- and fourth-degree algebraic equations with their “resolvents,” the impossibility of solving a general fifth-degree equation (or higher) using “radicals,” the “family” relationships between coefficients and roots, such were the questions I would have liked to explore in far more depth than the prep program for the exams allowed.

It is, in fact, always with algebra that I’ve felt most mathematically at ease, once the difficult task of penetrating the necessary axiomatic reasoning has been surmounted: be it the algebra of groups and rings, or the algebra of modules, even though they’re apparently so different from the elementary algebra taught in high school. And I reached, unfortunately only near the end of my most intense period of involvement in mathematical affairs (around 1970), the verge of understanding the grand theorem for the classification of finite groups, the famous Feit-Thompson theorem, which took up an entire issue of the *Pacific Journal of Mathematics*, using an *ad absurdum* line of reasoning that was pursued over more than 400 pages! As Bourbaki said, in the Introduction to his volume on Algebra: “Algebra is essentially concerned with *calculating* . . .”

Less directly, but more generally, there were the immaculate deductions of the Treatise, in their meticulous presentation and constant effort to cut deductive chains into almost trivial steps (for those who were sufficiently used to that kind of progression to be able to recognize this fact), their pedantic precision and labeling of definitions, propositions, lemmas, theorems, and corollaries, their incessant numbered and typographically highlighted references to previous results and concepts, which were now necessary for a given moment of proof or result, and, as I later learned, the numerous collective revisions and criticisms leading to corrections from one edition to the next with a view to attaining



impassible summits of clarity (to such a point that their everlasting quest for rigor and perfection made them fall instead into an advanced form of obscurity), were to become for me, and remain such for many years, a new and irresistibly seductive form of calculation.

However, these calculatory sequences of algebra or axioms, which were perfectly fixed, irreducible, and necessary, did not completely eliminate a mathematical fancy for imagined theorems, conjectures, or results that had not yet been announced or even presaged. But they did imply a twofold discipline, which in the end was quite reassuring: to dream using only them as one's starting point, and end point as well. They provided certainty.

But not at all a personal or original certainty—quite the contrary; it was the certainty of being part of a collective, universal, shareable certitude. When in doubt, this certainty could always be reconquered, and the mistaken dreams of irresponsible intuition corrected with a smack of the ruler on the fingers of the incorrect result that had arisen at the end of your reasoning, and always in the same way: by going back, starting the same calculations and the same successions of implications all over again. Patience and obstinacy were required—and time. The reward was feeling a sort of relief.

Thus, it was algebra, in this rather broad definition of the term, which attracted me most to mathematics, and not geometry. For me, geometry could be far too easily assimilated into physics (an idea that has been defended philosophically). In my shortsightedness, which was congenital, an intellectual weakness, but also willful, it was something that seemed far too much like a recourse to data external to the strict manipulation of symbols, thus requiring an intuitive comprehension. This gift of intuition, of geometric divination, which is untransmittable (my friend Jean

Bénabou clearly has it, and I have witnessed its sudden arrival, without any apparent warning, in my second daughter, Charlotte, during her antepenultimate year in high school (and it was all the more striking for me to witness the reality of this sort of intuition in her, in its non-elaborated state, almost like a pure, unalloyed metal)), is a gift I do not possess.

23 (§ 22 continued) **I sought out arithmetic.**

I sought out arithmetic. To protect myself. But from what? At the time, I would probably have replied: from vagueness, from a lack of rigor, from “literature” (in the derogatory sense of the word). (If I am providing another interpretation of my thinking in 1952, one that is more detailed, reasoned, and articulated, then this is through a voluntary, conscious, and “cynical” application of a process that our memories run through automatically all the time when they bring back to us what we pretend is the past: a construction, far more than reconstruction, of a historical event. I won’t go on repeating my warning that what I am writing has no claim to being a faithful reconstitution of the past; occasionally, however, when I feel the need, I shall indicate this with an arrow, pointing the reader toward this “moment” of prose, and of prudence.)

My mistrust of geometry, and of everything else in mathematics that requires similar qualities of intuition, which is born more of an inability rather than justified thought, was also a transposition of poetry toward mathematics. Having started out with metrical verse, I soon became enthused, like everyone else, by the torrid free verse of the Surrealists and their followers.

But this formal liberty, which was considered to be one and the same thing as liberty itself, bothered me, even though I had not yet identi-

fied it as being a simple submission to the most mechanical forms that inherited influence had to offer. It simply made me feel increasingly ill at ease.

What I concluded about this awkwardness, this increasingly paralyzing dissatisfaction that finally robbed me of the very joy of composing poetry, was that I had an absolute need (which needed to be met at once, in the name of the higher interests of my future existence; I wanted to be a poet, didn't I? It was what I desired most intensely) to isolate myself as completely as possible from my poetic environment, rather as Stendhal had done by emulating the prose of *Le Code Civil*, that legal form of algebra.

My state of desolation, almost of shame, at the period I am evoking in the chapter, was due to the fact that disturbing my university education had apparently served no purpose, and had not provided me with poetic salvation. While, in mathematics, I was lost.

Nevertheless, though I was only to discover the fact later, I now held the solution to the "poetry crisis" in which I had submerged myself at the time, and into which I had been cast by my adolescent adhesion to Surrealist modernism, and even more so (by cutting off any possible return to traditional verse (in poetry, "one never changes back")) to "socialist realism."

#### **24 (§ 9) Totally immersed in coolness, and facing the rippling glints in the pond,**

I get out my little notebook with its oblique orange/yellow lines (there it is, on my desk, just below the screen), purchased at the stationery store on Ile de la Cité, just a few feet away from the statue of Henri IV (and

where I buy most of my variously colored folders, which one day, when I have the time (a day that is always being put off till a more convenient future), will house all of my papers, appropriately divided under different headings that can be semantically identified at a glance thanks to the color of the folder in question: red for mathematics, blue for poetry, green for prose . . .).

I then remove from the right-hand pocket of my trousers my card-holder (here it is), which contains in particular my “visa card,” my cards for the Bibliothèque Nationale and the Sorbonne library (plus others too numerous to mention), and from my card-holder that marvelous, flat two-tone pen (just look at it), which was a gift from Marie during a trip to London (most of our stays in London are spent, when not in the pub, either at the markets of Camden, Petticoat Lane, or Portobello Road, or else in stationery stores), so as to use it to take preparatory notes for the Oulipian homage to my friend Jean Bénabou on the occasion of his sixtieth birthday, which I intend to present to him the next day.

(In other words, today.) (In other words, it was written on a Sunday, it’s a piece of encomiastic “oral prose,” which was indeed pronounced that evening in a fourth-floor apartment on the corner of Place Denfert-Rochereau, after the candles had been blown out.)

It is, thus (as I wrote that Sunday morning, as I said that Sunday evening) Saturday, May 23rd, 1992.

But why, you might ask, abandon the comfort of a desk and the screen of a Macintosh LC for an austere bench in the Tuileries and the distractions of carp and ducks? It’s quite simple. It is on Saturday morning that Christine, the cleaning lady of 51 rue des Francs-Bourgeois, where Marie, Charlotte, and Ophélie the cat live, attempts to impose a semblance of order in my apartment at 82 rue d’Amsterdam, in the 9th arrondisse-

ment of Paris, when she is not attending to her aged father (in Togo, or else in Burkina Faso).

She opens the door with her key and says: “Good morning, Jacques.” I reply: “Good morning, Christine.” I save whatever I was composing, turn off my Macintosh, pick up my things, put them in my “Big Shopper” bag, and leave. It is impossible to have a Macintosh and a vacuum cleaner switched on at the same time in my apartment. So, it is vacuuming time. I vacate the premises.

25 (§ 24 continued, part 1) **The other day, Marcel said to me on the phone:**

The other day, Marcel said to me on the phone: “What if we gave him something Oulipian?” (Marcel Bénabou, member of the Oulipo and eminent historian, is Jean’s cousin.) “What an excellent idea,” I replied (Marcel always has excellent ideas). “What about the constraint?” I asked. “Well, you know, the usual one.” “You’re right,” I answered. “We don’t really have enough time for anything else.”

“That’s what I thought,” said Marcel, who in fact has very little time for himself, given the fact that he devotes at least ten times more hours to his university than nearly all of even his most conscientious colleagues, and with long-established devotion takes care of the duties of the definitively provisional (or provisionally definitive, or vice versa) secretary—as well as the archives and finances—of the Oulipo, the *Ouvroir de Littérature Potentielle*, founded by François Le Lionnais and Raymond Queneau, of which we both have the honor to be members, while also, having written none of his books, abruptly setting about writing all of them (or nearly).

So, yesterday morning, in the Tuileries, I got out my little black notebook with its (oblique) orange lines and my flat pen and I began at the beginning. I started by drawing up preliminary lists: the list of letters made available by the constraint, the list of usable key words, the possible syntactic constructions, and above all the meaningful words, the words able to condense the essential sense (or, more exactly, the *sen*, according to Chrétien de Troyes) of the work that I hoped to bring together, in the *molt bele conjointure* (to quote Chrétien de Troyes once more), below a constellation of strikingly allusive images, with a heroine, Dame Theory of Categories, and her champion, Sir Jean Bénabou.

I failed miserably.

Let's put this down to a lack of time.

After half an hour's vague rumination, occasionally punctuated by reading a few lines from the *Times*, which I had started buying again after a few weeks' break (to punish the British for their behavior during the last general election, which I disapproved of, I had decided to stop reading it; but Marie pointed out (noticing no doubt the obvious worsening of my moods), that I was in fact the one (among certain others, admittedly) who was most punished by this boycott, which may well have been politically courageous, but which was also rather ineffective), all I had at my disposal were two words, the second of which was English (whose meaning, to top it all, I had forgotten!):

1) banjo

2) jejune (dull, dry, according to my *Robert & Collins*)

What is to be done? as Lenin once asked.

26 (§ 24 continued, part 2) **What is to be done?** as Lenin once asked.

Not only was this meager, not only did using these words seem problematic to say the least, but they seemed to display, once I had recovered the meaning of the second term, a certain spontaneous pessimism about the extent of the task awaiting me and which I had accepted without thinking things through first (“All Marcel’s fault,” I said to myself).

And since the only suitable, appropriate fragment that I managed to find went on to provide the title of the piece I’m telling you about, it would perhaps be better to give you the raw data, from the pages of my notebook, which reflect the chronology of my labors more faithfully.

You can consider these as scraps of material that will allow you, I hope, to complete my interrupted work (after all, “poetry,” according to a famous “retired civil servant” (perhaps an Inspector of Weights and Measures), Monsieur Ducasse, “must be made by everyone, not by one”). (I should like to take this opportunity to point out to Monsieur Ducasse that poetry is necessarily “made by everyone,” and not by one, because it is language, and thus reflects a part of the biography of one’s language; it is for this reason that it is “uninterrupted,” except by death (of the language).)

– Here they are:

*banjo   jejune   jeune, jeûne, à jeun, je  
ban*

*Ben (Big?), benne*

*job, Job oboe*

*un bé à ba, un baba*

*boue, bouée, boubou, joue, bajoue, noue, noué, nouba, nô, Noé,*



*neon, neu-neu* (rapid discovery sequence)

*nu, nuée,*

*eau*

*naja, nana, nanan*

*onu, noon, none, none*

*ô, au, on, ne, né, en, éon, eu, eue*

*aube une aube?: beau!*

*un beau jeu, un bon jeu, un enjeu enjoué*

*un an, une bonne année, Anne, Anna, on bée, Enée, abonné, non!*

*non!* (rather a disorderly burst of inspiration!)

*ébène*

*nabab, baobab, boa, Banon, jojoba, jubé* (another word whose meaning I didn't know; luckily Florence gave (no, loaned) me a picture of the one in the church of Saint-Etienne-du-Mont (1521–1545), so here it is, on a postcard)

*bab, bébé, bobo, bubu* (Bubu of Montparnasse? Or “Bubu,” the abbreviation of Buxane, my niece Marianne's sable collie?), *bonbon, bonbonne*

*jujube*

*jab*

*abbé jaune, béjaune joe, jojo, joujou*

*na!*

299 JXT 75, rue de Rivoli, May 23, 11 A.M. (Sorry, this has nothing to do with the constraint. It's a Parisian license-plate number. I collect plate numbers. More exactly, I look for the most recent ones. This allows me to keep a certain mental control over cars, those mortal enemies of pedestrians. When I see a horribly new car drive past, I say to myself: “But you aren't the newest! You little idiot, there are three, four, even 5,000 ahead of you!” I also have another strategy. I sing to myself the song

I composed for them, the Song of the Parisian Automobilists: “Drive through a red light, then drive through two / To scare the little old folk / Good health to the funeral parlors / And fuck the lousy walkers / We’ve declared war against them all!” (Charlotte doesn’t think that I’ll get into the top fifty with this song. Not that she disapproves (nor does Laurence, who’s training to become a doctor in the prison hospital at Fresnes), but her entrance exams, to the Ecole Normale Supérieure Section C (biology), don’t leave her with enough free time to quash my singing career.)

The last word on my list (on the way home) was:

Ob (the river in Siberia)

And that’s all! (That was all. No one identified the constraint. Oral presentation doesn’t lend itself to the decipherment of letter-based constraints. Such as this one. It’s simple. After me, Marcel offered up a few aphorisms adapted to include the names of mathematicians. The first one, excellent in my opinion, was:

*Nul n’est censé ignorer Galois*

*(Ignorance of Galois is no defense.)*

## Chapter 2

### General Bourbaki's Coup d'Etat

#### 27 **That machine for manufacturing recollections, my memory,**

That machine for manufacturing recollections, my memory, has put at my disposal this example, made up of two logically separated periods of time, which nonetheless fade into each other and are chained flexibly into a single image: a voice interrupts the lecture. "Choquet" comes to a halt and looks questioningly in the direction of the voice. It comes from someone in the middle of the lecture hall, in one of the central rows. His southern-accented voice is indignant. I do not know what the voice is saying. I cannot see who is speaking.

Yet, I know that what the voice is saying started with "But"; something is being said along the lines of: "But, you can't affirm such a thing, because . . ." Or else, "But what makes you think that . . . ?" The voice's indignation has been caused by a perceived lack of proper deduction. The listener is being "taken for a fool," being thought so little of that he doesn't even warrant a genuine proof. Mathematics is being replaced by sleight of hand.

All of this is implicit in the initial "but," that off-switch for the magical current of professorial discourse (working rather like the switch on an electric circuit, which can act as a model, or a "piction," of the "no" operator in ordinary propositional logic). I can still hear this "but," which is charged with such meaning only in

the future-perfect tense of that moment, as is the case with all past utterances.

Choquet breaks off. He is neither offended nor troubled. Being neither offended nor troubled by that indignant voice is yet another part of the everything that stupefies the Integral and Differential Calculus students in the academic year of 1954–55, part of that off-putting upheaval in mathematics. He can't possibly have planned this interruption, or arranged it, like a magician planting an accomplice or colleague in the audience. The indignation in that voice was too sincere.

But it does not astonish him. Paradoxically, he seems satisfied (paradoxically, because the voice is accusing him implicitly of imbecility or dishonesty—such were the underlying judgments which had been pronounced in that “but,” backed up by its intonation): inciting such indignation is simply another part, so it seems, of his task as a teacher; it is at least as important as disarming his listeners with savage truisms.

He turns toward the board, back to what he has written on it, which provoked the owner of the voice's anger and inspired his iconoclastic interruption. Choquet allows himself a moment's thought, then says: “. . .” Sure enough, I don't remember his exact words—it was either: “You're quite right . . .” Or else: “Nonsense, you're mistaken, because . . .” (given the way that the future of this moment has been inscribed in my past, I would wager it was the former), but this doesn't have the slightest importance. Choquet is not particularly concerned about being right on this point, nor particularly concerned about being wrong. Nor does he call upon the rest of the lecture hall as his witnesses, or ask for their opin-

ions, as his colleague Schwartz used to do rather histrionically before him ( $\rightarrow$  § 36), at the time when he taught the MMP certificate class (Mathematical Methods in Physics). Instead, Choquet clearly lets it be understood that what has just happened is natural. He replies, then proceeds.

Immediately the image, as invented by my memory, moves down the lecture hall, into the gap that separates the first bench from the long, slightly elevated table, between the auditorium and the board, behind which Choquet stood and spoke. He is no longer there. This is a moment after a lecture. There's a sort of clot of students standing silently around a discussion. We are witnessing a debate between two protagonists who, following the tradition of the realist novel, which I frequented extensively back then (in its English version), I should now present to the reader. In such a novel, I would then write: the first of these two students was a young man aged about twenty-one, with . . . hair, . . . tall, wearing . . . , whose face reflected . . . But even if I wanted to, I could not write like this. I might say that the small crowd that has gathered around to listen to the two is hiding them from me, or that I'm too far away to see them. But those aren't the reasons why.

Their faces do not matter much, in fact. What does matter is what they're saying, what they gave their listeners to hear, what their discussion taught me. It's far from certain that the scene actually took place like this, this brouhaha which I'm fishing up from the murky depths of memory's soup, but what matters to me now is this lesson in allegory, and the way it insists on finding a support for my recollection. So, why not like that?

In the brief dialogue that followed, the voice of the interrupter from “just now” is there, and still questioning, but in a quite different manner. For a second voice can be heard, which is affirming that what Choquet has been saying is simply the rather trivial froth on the surface of something far more vital, rich, complex, and profound; then a name is uttered: Bourbaki. I hear this name, because I am there at that moment, both near and far; close enough to the voices to hear them, but not participating in the conversation. At that instant, I am not really concerned by what is happening. I catch what is being said distractedly. I do not grasp its significance. I give it no meaning.

**28 At the moment I am writing these lines (in May, 1992),**

At the moment I am writing these lines (in May, 1992), the “biography” of that many-headed beast, Bourbaki, is still to be written. It would be a fascinating but arduous task. Here, I shall say only what is strictly necessary to my own enterprise. Having reached his dotage after 1968, “he” is for all intents and purposes now dead, if I believe what Pierre Cartier said in September of last year, in Cérisy. (“He” was already decidedly weary when I had the opportunity to approach him, albeit in rather a roundabout way, circa 1965.) But in 1954, he was still vibrant, forceful, conquering, full of ardor and ambition.

We now know that this “he” was a collective pseudonym, as they say on library cards. In 1962, my master, Raymond Queneau, wrote an article entitled “Bourbaki and the Mathematics of Tomorrow” for the revue *Critique*, which was subsequently

reprinted at the beginning of his book, *Bords*. It contains the following passage:

*“It is generally admitted at the present time (in France and elsewhere) that the most important treatise of contemporary mathematics has been signed by an invented name; even worse, this name comes from a school joke. Originally, it was the name of a great, fictional Swedish mathematician who was supposed to be honoring the Ecole Normale with his presence, and who claimed to be called Nicolas Bourbaki. I have no idea if, at the time, those young men were already planning to write their treatise, inspired by the desire to give a rigorous foundation to mathematics . . . but their pseudonym was there waiting for them.”*

These “young men” of 1930, who had become prestigious masters by 1960, had become in 1990—those among them who were still alive, that is, and, in particular, the founders André Weil, Henri Cartan, and Jean Dieudonné—honored and venerable retired professors. Their voices, which became juvenile once more in memory of the “japes” that had enlivened the early years of their “child,” slur slightly and occasionally become confused when their voices issue all at once from my tape recorder, into which I have placed a cassette kindly sent to me by *France Culture*, of a Michèle Chouchan radio show devoted to Bourbaki: “Investigation of a Many-Headed Mathematician.” Among the various voices can also be heard that of Professor Choquet, now of the “Academy of Sciences,” and mine too! (though I am present for only the most trivial reasons). Bourbaki is now a museum piece. I make no attempt really to hear what they are saying. I’ve set the volume quite low (it is five o’clock in the morning), I am just trying to create an atmosphere to trigger memories.



Very few of the world's mathematicians in 1992 would still agree with Queneau's judgment of Bourbaki's written work: "the most important treatise of contemporary mathematics." Much mathematical water has since passed under bridges of the same kidney, and Bourbaki's stock is now rather low, if the reader will excuse me such an incongruous mingling of metaphors. The history of the sciences, in its serene impartiality, will no doubt give them the place they merit once the last of their disciples, enemies, or hangers-on have left the scene.

But in 1954, their name had hardly spread beyond the circle of professional mathematicians, and even among them it was still tinged with mystery and horror. In the Hermite lecture hall, no one, or nearly, had ever heard those three strange syllables, apart no doubt from the *Normaliens* who were under the strict guidance of Henri Cartan (a decisive step for Bourbaki, in its long march toward mathematical power, had been to take control of all of those heads and their various brains, all predestined, of course, to be brilliant).

When recalled later on, much later on, this moment thus acquires an almost solemn dimension. From the little thicket of heads around our two protagonists—the one who created an "occurrence" by interrupting Choquet, and the one who has not only taken up the professor's defense but has now stolen the limelight by providing an explanation and a wider context for the discussion—the name takes wing over the rows of benches, fills our ears, rises up to the ceiling, and vibrates against the walls, which send back an echo: "'Tis a cry repeated by a thousand sentinels, / An order announced by a thousand megaphones / 'Tis a beacon lit on

a thousand citadels, / A call to the hunters who are chilled to the bone! / Bourbaki! Bourbaki! Bourbaki!”

The essential revelation was as follows: those items now termed mathematical in a sense that escaped reasonable folk had not been invented by Mr. Gustave Choquet, and were not the ravings of an eccentric professor (we suspected as much, of course); and, above all, there lay an overriding rationale for all this somewhere. Mathematics had recovered both its unity and *élan*. For the first time since perhaps the golden age of the Mediterranean and Greece, since Euclid and Archimedes, it would cease progressing haphazardly, weighed down by the unbearable risks of disorder and contradiction, and would be new once more, borne up by a vision and mission.

It was starting all over again.

And there was a “treatise” to “make this apparent.” That monumental work had started to appear. And it was appearing under the name of “Bourbaki.”

**29 In the beginning, it was as a treatise that I imagined Bourbaki, far more than as a group.**

In the beginning it was, thus, as a treatise that I imagined Bourbaki, far more than as a group made up of living mathematicians. However, it would seem that my reaction to the proclamation that had been made to me, and to everyone else, given that I had taken the time to listen to the discussion, was slow and materialized only several months later. I always react extremely slowly to events of any importance. And even when the penny finally drops, I still

beat about the bush with a hesitation that causes me much despair before taking the actions that my fresh understanding now requires. For all practical purposes, I am only too willing to adopt the motto of Alphonse Allais (or Mark Twain, I'm not sure):

*You should always put off till the day after tomorrow what you should have done the day before yesterday.*

I have a long experience of procrastination. I dither for ages between duty and anxiety, unless it's the other way round, or unless the former derives from the latter, and they support each other mutually. I am perfectly aware of this. I recognize an effect perhaps resulting from genetic-moral transmission, or at least from indirect nurturing by my parents: my mother (in her own words) *tourine et tarpane* (meaning she *fretted* in her bastardization of French and Provencal) and my father (still according to her) *procrastine*.

The discovery of the existence of Bourbaki as a place where solutions to the "Choquet style" of teaching would be made explicit and amplified into a vast synthesis, inspired no immediate reaction in me. I slumped back into a pessimistic lethargy, was more and more adrift, and irrevocably tardy in my understanding of lessons that glided rapidly across areas that, it seemed to me, needed lingering over far longer, more rigorously and less casually (in the words of our "Bourbakian" informer, who was none other, to put matters straight at once, than Pierre Lusson, today my old friend, who put in a premonitory appearance in the very first moment of this prose-route).

I hesitated, all through that numbing winter, almost convinced of the failure of my attempt at a *vita nova*, but still not

absolutely resigned to abandoning it, to returning to my literary rut, or to accepting, in what would to my eyes have seemed both a defeat and a facile solution (and not forgetting that I would first have had to acknowledge this fact, and so “lose face”), another destiny: that of studying languages, and in particular English. I felt extremely alone in that “amphi” (a term that in this case combined a “container” (the place, the Hermite lecture hall) and a “content” (the students all working for the same certificate)).

None of my friends from my prep class were there. They had either won, as “three-halves,” places in one of the prestigious engineering schools, such as the Polytechnique, Centrale, Supaéro, Les Ponts, Les Mines, Chimie de Nancy (or elsewhere), or, having been transformed into “five-halves” during the vacation, they had gone back to the prep class that fall so as to try again (“ $3/2$ ” and “ $5/2$ ” being the age-old school slang for those who succeed, respectively, at their first or second attempt in their rite of passage to reach one of the above schools (this fractional jargon being opposed to the more basic, or plain Pythagorean terms for their literary counterparts, who were either “squares” or “cubes”). At the time, one could persevere even longer against failure and become a “ $7/2$ ” (or else “bi-square”). School legends even spoke of “nine-halves,” and why not “eleven, thirteen, fifteen or seventeen-halves,” who had gone insane, and now wandered the corridors like ghosts).

In other words, I knew no one at the beginning of the year. The tiny “students’ common room,” which was put rather grudgingly at our disposal, was just opposite the main entrance to the “amphi”

and, little by little, despite my distraction and reticence, I managed to pick out a few faces in what had initially been a homogenous, shifting mass; then, as time went by, while I wouldn't say that I went so far as befriending anyone, I at least started speaking to half a dozen of them.

Three and only three of those students became and long remained my friends.

I search, with the decidedly impractical inner gaze of memory, which it is almost impossible to direct simply in the required direction, and almost impossible to focus on a given point in the partly imaginary space-time that constitutes the past (and which certainly doesn't conform to our acquired, learned, thought-out representation of it; in other words, it's not at all "four-dimensional Euclidean"), through the hazy, gray, fragmented crowd of faces that move fleetingly through the apparently random waves of that ocean; and it is they, and almost only they, whom I can identify with any certainty.

But, independently from the "living" or "biographical" tissue of those relationships—for what motivates me here is not an undifferentiated autobiographical scheme, in which all the pathways of recollection are of equal value—it so happens that these three friends symbolize rather well, in terms of my present thinking, three highly divergent ways of reacting to the Bourbaki revolution. I shall present them here just so, almost as allegorical figures. I can only ask each of them to pardon me this "abstract" approach. Although for one of them, alas, any pardon I may receive will be entirely posthumous.

**30 If you accepted the revelation that there was a new prophet of mathematics,**

If you accepted the revelation that there was a new prophet of mathematics, one of three attitudes could be adopted, and I shall trace each of these three lines of strategy in turn, analyzing them in their pure state by incarnating them entirely and abusively in each of the representatives I have chosen, even though these friends' real positions were, like most of the students who attended the lectures, a mixture of all three, albeit in unequal proportions:

- a) the line of pure obedience;
- b) the line of pure belief;
- c) the line of pure anticipation.

According to the line of pure obedience, it was enough just to adopt whichever of these Bourbakian revelations was absolutely necessary: provisionally, that is, for the purposes of this sublunary world—in other words, the world of coming exams. But there were in fact very few cases of this. The conquest of the Integral and Differential Calculus lecture hall in 1954 was by no means perfectly coordinated, or programmed synchronously with equivalent positions in provincial universities, some of which had even preceded it along the road of modernization; and especially not with the hiring committees for posts in the national education system, which conserved, and would conserve for some time, a strict classicism, and even an exacerbated non-modernism, inspired by the (justified) prescience that the current situation posed a serious threat to their omnipotence. This was a source of serious conflicts, in which everyone in my



mathematical “generation” became more or less directly embroiled (→ § 42).

Thus, it wouldn't do to allow oneself to think permanently about mathematics in this new, incongruous, fantastical way. It endangered the future of the vast majority of students who were preparing to become high school teachers, and whose main ambition was simply to pass the end-of-year exams. It was necessary, therefore, to leave these “set” theories, with their extensions into topology and algebra, in their strictly limited place as a field of study that was fairly isolated from what had preceded it: in other words, the “real” mathematics which they would return to later, once they had got down to serious things once again. This position was backed up by excellent and pragmatic arguments. Here, I am apportioning neither praise nor blame. I am simply describing.

But, adopting the line of pure obedience also meant continuing to respect the implicit, traditional pact of education: learning with a view to transmitting the very same thing one has learned, without having any inner doubts about the conceptual model being used, and without forming or adopting any “personal” ideas about the question. (I use the word “inner” advisedly, because the external pedagogical revolts that were to shake up the succeeding generation in a far noisier way were accompanied by a flagrant lack of any change at all on this front.)

Our friend Marcelle Espiand chose this line and stuck to it obstinately. It was impossible to make her budge an inch. She applied all of her natural intelligence and Guadeloupian vivacity to countering arguments for a more ambitious immersion in new research. This wasn't due to any lack of understanding. Instead, the barriers in her



path turned out to be so great that they were insurmountable. Being female and also dark-skinned were two anomalies that, when combined, raised genuine obstacles in the world of higher education at the time, and appeared even stranger given the fact that she had chosen a field traditionally so unwelcoming to young ladies.

I don't know how she had managed to be strong enough to carry on despite all of the implicit and explicit words of skepticism and discouragement that punctuated her education, but she was now incapable of envisaging any horizon other than passing the *agrégation*, which was still sexually segregated at the time.

As such, she willfully set herself against any attempt by our little group, which formed gradually and took to meeting from time to time at "Plantin," the café at the corner of rue d'Ulm and rue Lhomond ( $\rightarrow$  § 43), to bring the conversation to bear on the thrill of the latest theories, such as the mysterious "cohomology" (I am anticipating slightly), with a smiling but decisive foreclosure: "That's not for poor nigger girls like me!"

However, there was more to her refusal than just renouncement. She was also making gentle fun of our imitative, childish fanaticism, and our peremptory attitudes as converts (here I am putting myself among the two other "lines" when I say "our," but in reality I wasn't close to either of them). She mocked our blind immersion in the twists and turns of this axiomatic stream, which was so pure and heady, and whose current was taking us towards a future that would turn out to be far less exalted than we hoped and believed. It was only much later that I recognized the vigorous truth of her implicit skepticism, as a secondary and indirect effect of my shock at her tragic fate.

She got high grades (before passing the *agrégation*, which so pleased her father, who was a math teacher himself, but without this distinction ( $\rightarrow$  § 44)) in celestial mechanics, manipulating with ease its ostentatiously classic but thorny techniques, and would surely have excelled in the combinatorics of heavenly motion, if only she had allowed herself to want to ( $\rightarrow$  § 45).

### 31 For Philippe Courrège, on the other hand, his belief

For Philippe Courrège, on the other hand, his belief—a pure belief that long sustained him—derived from a genuine conversion. Having arrived in the Hermite lecture hall rather by chance, toward the end of a chemistry degree, for which this certificate was not, I think, strictly necessary, he heard those words, which so shocked his neighbors, without any great surprise, because he had no true preconceived ideas about mathematics.

As he listened, he was soon surprised, then immediately put out, indignant even (this was, and is, a marked ingredient of his character) to observe that, instead of the excess of abstraction and rigor, which most people found so repugnant, there was actually a woeful lack of these very qualities in the lecture. It seemed to him, and he was quite right, that if objects were to be presented with great axiomatic simplicity as elements whose intuitive contents were as poor as “sets” and then engaged in manipulations that were generally, it had to be admitted, “trivial,” then far more time should be spent detailing and justifying the choice of the mechanisms in question. The notion of a set, like that of an element as a member of a set, seemed in the end,

as far as he was concerned, to be far more vague and less rigorous than that of a basic chemical element within the periodic table.

The inner turmoil caused by these reflections finally boiled over, and he it was who caused the little quarrel I have described. Pierre Lusson had quickly begun to agree with Philippe. For Pierre, it was an unexpected chance to influence the course of events, and he didn't let it pass him by. But he had also offered the key to Philippe's dissatisfaction: "Choquet's deceptions" could not be put down to ignorance (of course not!), but instead the need to skim over matters that in reality deserved to be developed far more deeply. There was just one solution, one hope, he said, delighted to encounter a new mind to evangelize: Bourbaki.

The result was a radical conversion. Philippe immediately began reading the few Bourbaki volumes that had already been published, and started taking extra lessons by going to talk with Professor Choquet behind the "amphi" after his lectures. As Philippe was possessed of enormous initiative, none of this interfered with his likewise assimilating the terribly imperfect ideas, as he saw it, which were required to pass the exam (his dissatisfaction continued, but now he knew where to look for the right answers), which he passed easily. What's more, he decided to drop chemistry and devote himself to this new version of mathematics, which was rigorous, definitive, and pure.

If I have chosen him as the model of a Bourbaki "believer," this is, I repeat, in deliberately abstract and simplified terms. When I refer to "Choquet" as the person speaking to us, I am no more referring to "someone" than I am drawing up a real portrait

of Philippe Courrège here. I am inventing, as I go, as required (though I have as yet said very little about the reasons for this), a “Courrège,” more familiarly called “Philippe,” to whom I attribute (just as I have done with “Marcelle”) some of the traits that I have identified in a **memory game**, in a local sub-game of my overall memory game, in a certain (current, as I write these words) state of play.

Nor am I constructing imaginary characters, beings of paper and fiction. I don't have the daring (or presumption) of the novelist, who can't avoid tracing an outline of truth around the beings his fiction borrows or manufactures, and can use just one name when describing such creatures: he is like this, or like that. If I had chosen that path, I would have had to eliminate all the names, because there is (or was, in the previous example) someone who bears this name and who will not be satisfied by my retrospective vision. I may even find I do indeed need to adopt this strategy later, which would be a shame.

For, while affirming the abstract, restrictive approach that I'm adopting, I still need to try to show where, from whom, my conclusions truly derive: thus to establish the certainty, which may or may not be deceptive, of the memories in which I see all three of my friends as living beings, in which I observe them in the regions of my past that are partly theirs too. I could even compare my ret-roratiocination with their memories.

(This would be impossible in one case, of course, with Marcelle, though easy with Pierre Lusson; but if I wanted to question Philippe Courrège, then I should have to take certain specific steps, which gives me pause at present. In any case, I would use

my friends' testimonies only as commentaries to my text, as reactions, or reflections. In other words, whatever I learned from them could neither confirm nor invalidate my "model," but only confirm or invalidate the correspondence of my model (as a set derived from my memory game) with their own memory games, and so indirectly illumine and enrich it.)

Philippe Courrège's violently chemical, intellectual reaction to Bourbaki's conception of mathematics fascinated me. I admit that I observed with intense, passionate interest the highly individual, integral, idiosyncratic, adventurous, almost mystical way he ran headlong into what was a total, virtually physical immersion into this ocean of strongly articulated signs, not only because it was clearly and directly accessible to me, as a spectator (as opposed to that other improbable, extraordinary, prodigious, almost mythical figure, Alexandre Grothendieck, whom I only ever contemplated from afar) because we became close, but also because I recognized in him a formidable originality and force of persuasion, which obliged me in turn to define myself.

### 32 for Philippe Courrège

#### for Philippe Courrège

*With paper, pencils, ink, and colors, with  
 Signs and then with words, with rules for  
 Assembling them, with patience and the force  
 Of habit (also silence to be braved  
 Which corrodes your strength and, who knows? also*

*Verlaine's blue white sky there, schoolchildren's cries  
 Around), you make more than a tongue, a fine,  
 Heavy thing fulfilling that hard accord  
 Between thought, between language and the hand.  
 I hail you craftsman of mathematics  
 You example of a cloud-gazer and  
 Mark it for future undoers of tricks.  
 How sure is the tool forged by all, how fine,  
 Genius or not, he who builds from a sign.*

By adopting Bourbakian rigor, by seeing a demand for rigor as the primary trait of this “mathematical revolution,” Philippe turned it into a genuine morality, with a resulting aesthetic. Mathematics should be morally rigorous and, thus, be beautiful. It was in this, and in this alone, that its beauty lay.

But it was not so much in a rigorous reasoning that he had forged this ethics, but rather in a rigorous procedure. The primary point was the severity, the “Jansenism,” of the approach. Such an approach should be free from extravagance, should even be, on occasion, mechanical. But only the resulting rigor, which was visible, verifiable, justifiable, and reproducible on paper had any meaning or merit.

Mathematics was not a concatenation of terms, or a universe of ideas. Mathematics was written down and inscribed in the world by being written down and inscribed on paper, as a progression, with a pencil and then with ink, being blacked in, little by little, sequentially, in order, unambiguously, unhesitatingly. It was constructed according to rules, in scaffoldings and assemblages of



signs. Here lay its “meaning.” It had no other. “Do you know,” Philippe would ask, “what the set-membership symbol means in set theory? It means that.” Then, after laboriously and thoroughly cleaning the blackboard, he would draw a very large

membership symbol:  $\in$

hurriedly, almost angrily, speaking in an accent that had become even more lower-Alpine (his family origins) with emotion, during his frequent arguments with Pierre Lusson, who was exasperated by such “metaphysical” naivety (sometimes leading him to make bitingly acerbic, ultra-Carnapian pronouncements such as: “What you are saying has no constitutable meaning!”), given that Philippe had arrived at a position in which he allotted signs the actual status of a physical reality. In anticipatory plagiarism of certain late 1960s mystic (at best) or ‘pataphysical (most often) divagations, he had invented for himself a conception of his ideal activity that could be described (cautiously) as materialist. He had discovered the “material nature of writing.” But it was only mathematics, MATHEMATICS, which merited this quasi-apotheosis.

I can still picture him writing, crossing out, rewriting, slowly, stubbornly, with a stubborn slowness, hour after hour, during long hours that were unbroken, dense, full of effort, without fantasy, without daydreams, without any imaginative anticipation. His penciling was clear, thick, legible, broad, superficially inelegant, and heavily dotted with punctuation.

It always made me think of (Prévert’s?) “God’s identity card,” very well-known at the time: “Started from nothing, comma . . .”



For it was, quite incomprehensibly, yet fascinatingly for me, from these pauses with commas, semi-colons, and periods that, setting off once more, after a moment's hesitation (with an effort that was physiologically visible on his face), Philippe arrived, after several pages, at the provisionally satisfactory proof of a theorem; one more theorem that now appeared as a revelation, like one of those beings produced by divine labor alone, as evoked by the protestant Pierre Poupo in the fifth of his sonnets "On the Week of the Creation":

*Nothing was now missing from the Olympic dungeon  
When to his farmyard the Architect applies himself  
And with a vigorous word that he slips in the waters  
Like a pressure or a fertile seed:  
Without spawning or hatching, we see by their thousands  
Fishes that come forth and birds that pullulate.*

Yes, the breath of mathematical life seemed to have truly been slipped beneath the signs, as a "pressure" or "fertile seed"; this life had been breathed into them by the "axiomatic method," it owed everything to it, and nothing to any sort of genius. In it alone lay the power of conviction and discovery.

Philippe didn't at all consider himself to be an inspired, gifted or talented mathematician. He clearly saw himself as a craftsman, a maker, a *fabbro* of deductions ( $\rightarrow$  § 46), a carpenter of propositions, corollaries, and *scholia* (he was also a naturally talented wielder of planes and saws).

### 33 He said that he had no mathematical intuition or imagination

He said that he had no mathematical intuition or imagination at all, be it geometric or algebraic. Furthermore, not only did he refuse to give any value at all to intuition, he even viewed it with the utmost distrust. The fatal mistake attributed to Lebesgue, who thought, relying on his spontaneous view of the matter, that “the projection of an intersection of two sets is the same set as the intersection of their projections” was a lesson as decisive as a parable from the Gospels.

(“How,” asked Bourbaki (in a far less “obvious” context, that of the “pathetic spectacle of a continuous function without derivative”) “could intuition have deceived us to such an extent?”) In such conditions, in order to avoid the uncertain workings of our minds, it was necessary to look for inspiration only from an absolute submission to the rules and restrictions of the game.

It was a game apparently played mainly with symbols: specific, distinct, identifiable symbols that referred only to themselves, i.e., to their depiction, sketched out by a hand on some little scrap of matter in order to provide them with visibility. Ideally—in an ideal situation that was always hypothetically reachable but had never been reached for obvious reasons of time, facility, and ease—it should be possible to rely upon these symbols alone, and the rules for manipulating them. In fact, there was no need for language, or the words of everyday speech. These were present only thanks to an “abuse of language” as shorthand for symbols, abbreviations, for assemblages or the names of certain constructions. The language that was formed in people’s mouths should be treated with

caution. It was an impractical and deceptive collaborator. When in doubt, it was always necessary to return to written symbols.

It follows (as part of the ethical component of Philippe's conversion resulting from his new understanding of the current state of mathematics) that the worst sort of error was a lax proof or definition. A disciple of Bourbaki, as Philippe had now become, was horrified above all by anything incorrect. It was necessary to play the game without getting the rules wrong and above all—above all—without cheating.

Incorrectness was the only real, unforgivable crime; for mathematicians, it was what Lautréamont had had in mind when he wrote: "All the waters of the ocean would be insufficient to wash away one intellectual bloodstain." Philippe shrank with horror before some of Lusson's short-circuited proofs, and more especially faced with his overall epistemological off-handedness when it came to "ancillary techniques," as though a new Macbeth had just risen up in front of him.

The allegorical portrait of Philippe Courrège that I am here composing and fixing in place has been deduced in its entirety from a single axiom: his pure belief in the truth and validity of the letter of the lessons provided by the Bourbaki treatise. I witnessed this. I witnessed this in Philippe and I was of course (like everyone else, even Choquet himself, who found him a post in the CNRS) highly impressed. One day, Pierre Lusson said: "Philippe is the most extraordinary man I have ever met." Then he added, both affectionately and ironically: "As they say in *Reader's Digest*."

Furthermore, it should also be clear from the description I have given of his behavior that Philippe did not long remain in this

phase of absorbing and reproducing the teachings of set theory and topology. The lesson of Bourbaki, as he had appropriated it, was not limited to a simple a presentation of current mathematics, rethought from a universal viewpoint. While it hadn't been their intention, to quote their prudent umbrella-phrase, "to legislate for all time," the perspective that Bourbaki had opened up was vast enough to act as a guide perhaps for the entirety of any individual's active existence.

One could, and thus one should, go further. What mattered was to brand with the "axiomatic iron" even those things that had not yet been reached or established. Huge stretches of mathematics still needed tidying up before they could be established on sound foundations.

So it was that Philippe was led by this *élan* into becoming a researcher, where he encountered the question of Probabilities. But, for the moment at least, that will remain another story.

### 34 By naming my third pictorial model as the model of pure anticipation,

By naming my third pictorial model (allegory is a sort of "piction") as the line of pure anticipation, and by choosing to represent it with Pierre Lusson, I am adopting several drastic simplifications, the most serious of which is certainly to limit its application to mathematics, and, in the field of mathematics itself, to the consequences of Bourbakism. Lusson's position at the time was ampler, more general, philosophically broader, and not uniquely directed toward the philosophy of science.

However, I shall allow myself this appalling simplification because I am trying to determine (an identification necessary to the description, begun here, of the preliminaries to an intellectual adventure: my own ( $\rightarrow$  § 47)) the paths that were possible for me during that hard winter of 1954, while at the same time restricting them and providing them with sufficiently clear contours.

The essential characteristic of this attitude of permanent anticipation was as follows:

to take an interest only in what will come afterward.

In other words: in any given branch of mathematics, in any one of those sectors described elliptically in the program of the foundation and exploration of analysis (taking “analysis” in its mathematical sense) placed at the head of the Treatise, what is acquired becomes acquired, and thus, like everything that has been acquired, once it has been read, and thus known, it becomes, and remains, profoundly and everlastingly uninteresting. Like Baudelaire’s traveler, the Lussonian student then cried out: “This land bores us . . . Let us set sail!” And thus: “. . . we want / To plunge to the bottom of the abyss, whether it be / Heaven or Hell / To the bottom of the Unknown in order to find something new!”

During that epoch (and during our epoch, too (though “epoch” is perhaps too grandiose a term) though less blatantly, for many years have passed, plunging our neurons into the detergents of existence, which destroy or falsify their connections, and dull their sparking, of course) at that period, then, Pierre Lusson could have been characterized in intellectual terms by the extreme rapidity of his reasoning, associated with a no less extreme difficulty in stopping at the strict conclusion of a deduction, because such conclu-

sions were necessarily limited, had been reached far too quickly, and were by consequence immediately dull, as is any completed reality, given that it has become united with the present, thus becoming immediately out of date. In such circumstances, Pierre would at once make several further, instantaneous leaps ( $\rightarrow$  § 48) in directions that had not been indicated to his interlocutor, who was thus immediately sunk into utter perplexity.

As with any rapid, indeed headlong, intuitive approach, the point of arrival was sometimes precise and relevant, sometimes not, sometimes surprising but reasonable or enlightening, and sometimes surprising but incongruous (over time, it seems to me that the respective proportions of these two “outcomes” progressed in two contradictory directions: with a deterioration on the one hand (those detergents of existence once more, of course), but then also a real broadening (the wisdom of age, apparently)).

As the inner deductive sequences progressing from his own premises didn't always manage to surprise Pierre himself, he used to seize upon the reasoning of others, just as their sentences were being born, and finish these first ( $\rightarrow$  § 48), which sometimes had the drawback, if all the necessary hypotheses had not yet been pronounced by the interlocutor in question at the moment when he or she was being inserted mentally into Pierre's process, that conclusions sometimes arose that had only a very peculiar or distant relationship with the problem.

If, exceptionally (through distraction, or because he was pursuing an independent demonstrative conversation with himself at the same time), Pierre's partner in this dialogue (if I can use that word) arrived at the crux of what he'd intended to say, this



crux inevitably gave Pierre a feeling of “déjà vu,” and he at once became convinced that he had just thought this thought himself, or else had always thought it. It follows, if we limit the context to mathematics taken in its axiomatic perspective, that the slowness which was inevitably inherent to the painstaking precision of writing long, very long pages in which everything must be made explicit, must be checked, pondered, explained, and disambiguated, plunged Pierre into a state of irritable somnolence; and this reaction was even more flagrant when it came to proofs carried out on the blackboard. With an adjectival interjection (“technical!” “trivial!” “ancillary!”), he would impatiently brush aside all these preliminaries in his haste to arrive at the serious business, which very often turned out to be disappointing, because it was already familiar, or quite simply knowable. (I shall here re-quote Stein’s axiom (which I sense I have already quoted not too long ago (long in prose, I mean), though I can’t remember where): “If it can be done why do it”).)

For Courrège, whose pace and rhythm of thought were fixed precisely by the rules making each step, even the most minor ones, absolutely explicit (particularly during the beginnings of his apprenticeship), “work” sessions with Pierre on the blackboard or in the café were a constant source of exasperation. Because he would have preferred things to be taken far more slowly, calmly, and in a strictly ordered manner. Furthermore, Pierre’s constant interruptions in the middle of Philippe’s sentences, never forgetting his brusque digressions, disarmed Courrège, because he could not and would not even conceive of forming a conclusion before beginning the actual act of establishing it (without realizing it, he



was at the time close to the concept that truth is only constructed step by step, which is an aspect of what is called, oddly enough if seen in this way, “intuitionism”). He usually ended up by breaking off and furiously wiping clean the board.

Philippe was especially furious when he discovered, which happened quite often after due reflection, that what he had been told was obvious, well known, or a clear consequence of the rest, and was indeed (respectively) obvious, well known, or a clear consequence of the rest. But he was unhappier still when it turned out—which also happened—that it was all quite simply false. And yet, however much these “exchanges” seemed unproductive, they were still necessary for him, and not just because he remembered that he owed to Pierre the discovery of Bourbaki, which had been so decisive for him; but also because he was quite aware of the implicit richness of the realms whose existence was now being revealed to him, albeit in this unsatisfactory way. Because the Lusson “method,” driven by an all-embracing intellectual curiosity, and the desire to see the flipside of mathematics, was a clear corrective for the limitations of his own fanatic verifications.

### 35 “At my age, Galois was already dead”

One inevitable personal consequence of the anticipatory position taken by Lusson was disenchantment. Firstly, and quite trivially, because his disdain for exercises, and his inability to submit to the strict rules of painstaking proof, prevented him (and he realized it) under the conditions of the period (and of his university career, since he wasn’t a *Normalien* and so couldn’t benefit from any leniency in his environment) from attaining scientific glory (→ § 49)

of the highest order ("for without technique, a gift is just a dirty habit," as Brassens sang). And any lesser form of glory would have been insufficient. He wanted to be "Chateaubriand or nothing," (replacing Chateaubriand in this famous dictum by Euclid, Euler, or Gauss);

but also, and less externally, because the development of his theories, which he was always anticipating and which always moved too slow in his eyes, was suspended in a continual imbalance between the hope for untold marvels and disappointment. But, having soon taken in all that Bourbakism could offer, conceptually, at its most advanced (with the notable exception of "class field theory"), he witnessed, at the same time as he was frequenting the Integral and Differential Calculus lecture hall in the company of utter, insignificant beginners like us, the arrival of the most extraordinary, indeed final representative of this mathematical "approach," Alexandre Grothendieck, during his "famous," but "secret" seminar devoted to "Abelian categories."

Seen from a distance, Grothendieck, who was then at the start of his astonishing career, was the true Galahad of contemporary mathematics: a dazzling robot. He possessed both a knack for developing new concepts with extreme rapidity, as well as a perfect mastery of the strict, exhaustive, laborious constructs and manipulations lurking in the forest of proofs. There was no point trying to compete with him. The effect of this person's very existence on Pierre was overwhelming. He summed it up in a single sentence, which I've never stopped mulling over:

**"At my age, Galois was already dead."**

As I have provided a glimpse, by comparing the Grothendieck of 1955 to Galahad, of an image of the Arthurian forest, with its enigmatic interweaving of adventures and quests, I shall continue in a forestry vein: as for me, I was at a meeting of paths, in a sinister, wintry clearing. Three ways lay open for me, but I was incapable of choosing one of them.

I knew, because it was impossible for me not to know, that I would soon have to take the first of them, that of at least a minimal obedience to the academic demands made by my exams, or else I should have to give up any hope of working as a professional mathematician.

But, at the very moment when I was telling myself as much, I was incapable of escaping from the dangerous attractions of the other two paths. It seemed obvious to me that it was in the “Lussonian” direction alone that I might find an answer, if any existed, which I as yet did not doubt; the answer to the question that had launched me into this quest: what is mathematics? What is the world, or the aspect of the world, or else the portion of the world that is illuminated by mathematics? And then, once that query has been posed and answered: what is poetry, inside or outside this piece of the world, as explained by mathematics?

But, as I was not, and never would be, a mathematician in the sense that Grothendieck was, or that Pierre Lusson could have been, there still remained the third path, that of Courrège, to progress slowly but perhaps more surely, with a delay I would never make good (but what did it matter?), along that same ultimate road, toward understanding.

And Courrège's example also offered me a chance to accomplish half of what had been essential to my dream of a *vita nova*: to become a mathematician by simply deciding to do so. Philippe was the living proof that this was possible.

I decided to begin at the beginning.

## Interpolations in Chapter 2

**36 (§ 27) Nor does he call upon the rest of the lecture hall as his witnesses, as his colleague “Schwartz” used to do rather histrionically before him**

Laurent Schwartz, then almost at the zenith of his prestige, was, unlike Choquet, a strict, orthodox, influential Bourbakist. It was rumored that he was a member of the group, whose composition was in principle secret, and one of those whom the “founding fathers” had recruited from among students at the ENS who graduated after them (the founders all came from the school, and were called in its slang “archicubes”), following a strategy of renewal by co-optation that was designed to last as long as the writing of the Treatise (and perhaps even beyond, maybe even for centuries; after all, hadn’t the Catholic Church calculated the date of Easter until at least the year 30,000 AD?).

I am not presenting any of these statements as historic truths; they are only my recollections of the image I formed of this secret society, little by little, thanks to the “revelations” whispered around the IHP during the time I frequented its corridors. After a number of years, Bourbaki had succeeded in forming a sort of ideal, trans-generational class of the ENS, department of Sciences (in the (imaginary) sub-section of mathematics).

Schwartz had been one of the first (and the first Frenchman, soon followed by Jean-Pierre Serre, then by René Thom) to win the prestigious Fields Medal, which was intended to stand as the Nobel Prize for Mathematics. The Fields Medal made good the terribly hurtful, for mathema-

ticians, “omission” of their discipline from the list of Nobel categories.

This lapse of memory is often attributed to the ill will of the originator of the prizes, none other than Mr. Nobel himself. According to the legend, which is worthy of the way ancient myths explain great events in the histories of Greek cities by attributing them to the romantic rivalries between the gods of Olympus (after all, doesn’t divine Mathematics claim its direct “descent” from the Greeks, and in particular from Athena, Zeus’s intellectual daughter?), Mrs. Nobel, the bored wife of that great capitalist who spent all his time with the money he earned from his dynamite business (the mention of which provided the opportunity to emphasize how “impure,” humanistically, the Nobel prize money actually was), had taken solace in the arms of a mathematician.

(The mathematician in question has always remained nameless: despite our praiseworthy attempts to include a new detail in this rumor, Pierre Lusson and I failed to attribute this role to the great Sophus Lie (who was Norwegian!)) Mrs. Nobel’s misbehavior allegedly called down the entrepreneur’s thunderbolts (to coin a phrase) less upon herself (little attention was paid to her own fate, she seemed such an insignificant part of history) than on her seducer’s discipline; with an irate pen stroke, its name was crossed off the list of prizes, thus consigning for a “century of centuries” (at least, such was the intention behind this gesture) the cursed race of mathematicians to a lack of Nobelian glory, and thus relative poverty.

37 (§ 36 continued, part 1) **However, the originators of the “Fields Medal” had emphasized their disdainful refusal**

However, the originators of the “Fields Medal” had emphasized their disdainful refusal of any association with the Nobel prizes. (But this turned

out to be in vain, at least so far as the “general public” is concerned, because the press, for example, always tags its announcement of new (four-yearly) medal winners (when it makes any mention of them) with the parenthesis “the Nobel of mathematics.”) For one thing, new laureates would only be crowned every fourth year.

This “Olympic” periodicity might be seen as a discreet allusion to the ancient primacy of the “queen of sciences,” which will put itself at the service of others only if it so desires, just like a certain king of France who, once upon a time, devoted himself to publicly washing lepers’ feet or (only on coronation day) placing his hand on scrofula sufferers. As the announcement of the “Medals” is made at the International Congress of Mathematicians, a similar kind of ceremony could be conceived, during which the winner would cure a few young minds cursed with the inability to calculate or reason.

Furthermore, on each occasion, there are several medal winners. (I’ve just realized that I have no idea whether the medals are purely abstract and honorary, or if they’re accompanied by a concrete symbol, made of chocolate or gold. Originally, they were four in number (is this yet another trace of an Olympic dream?).) Even if the average comes out as one per year, same as for the Nobel (if we ignore the Nobel prizes that are shared), awarding the medals in lots of four shows that mathematics is not just about individual glory, but collective effort.

Finally, the remaining element of ostentatious originality is that the happy winners must have been under forty when the discovery that won them the award was made, which shows (???) that mathematics is eternally, resolutely young. The rather childish nature of this rule, or institutional consecration of a very widespread cliché, shows that a community (scientific or otherwise) can be made up of intelligent people (even if this



intelligence is often of a highly restricted application) and still behave collectively in a quite frankly stupid manner.

Of course, the prestige of the winners of a “Fields Medal”—even if quite low among the “herds” of the “a-mathematical,” who know nothing about it, and extremely limited as well among the political and other authorities of the countries where they reside—is considerable in the math “milieu”; especially because most mathematicians are convinced that the “Fields” decisions are far more justifiable than those of the common-or-garden Nobel prizes, these being more “influenced” by external, financial, or geopolitical concerns.

There is some truth in this belief (or else I am being naïve, and remain slightly infected by ideas that I once thought to be indisputable), even if it can be argued that this virtue has been gained “by default,” given the lack of financial or geopolitical importance attributed to mathematics.

38 (§ 36 continued, part 2) **Schwartz regularly set off a shudder of stupefaction in lecture halls**

Schwartz, then, regularly set off a shudder of stupefaction in lecture halls—which must have been maximal the first time it occurred, but which remained extremely potent from one year to the next, or for the first few years at least, given that most of the students were replaced by a new intake every November—thanks to certain iconoclastic teaching techniques, whose bright-eyed guinea pigs would then spread the word to those of their “colleagues” who were still under the heel of more dull, traditional methods.

He had taken over the teaching of a certificate that was perfectly suited to his character, which was called Mathematical Methods for Physics

(MMP or “emempee” for the initiates), because he still bore the aura of his recent “Fields” laurel wreath, which had been awarded to him for the invention of a theory, the Theory of Distributions, which (according to the apprentice mathematicians who attended his lectures) had been put together from scratch so as to give a precise, rigorous meaning to certain irresponsible fantasies devised by physicists, such as the mysterious functions of Dirac or Heaviside. This interpretation was said to come from Schwartz himself who, though never explicitly stating the case, apparently gave his listeners the clear impression that it was correct (I will not go so far as to confirm the truth of such a statement, because I never heard him speak of it myself).

It was enough to know about the existence and ambitions of Bourbaki to realize that Schwartz was a member of that small, prestigious band, and thus, if likewise convinced of the intrinsic superiority of mathematics (which we did indeed see as the “queen” and not the “servant” of the other sciences (an idea that, from bench to bench, and from head to head, lingered long enough to penetrate the world of Letters (which became “human sciences”) during the 1960s, with the devastating (Levi-Straussian, Barthesian, and Kristevian (in rising ‘pataphysical order)) effects we know only too well), for us to imagine that we were participating in the beginnings of a general disruption of science’s conceptual tools: the axiomatic strategy, inherited from Hilbert and perfected in Bourbaki’s masterpiece as a new Discourse on Method, was going to “give a purer meaning to the sayings of the tribe of physicists” (and chemists, among others, whose “recipes” would benefit from a healthy dose of group theory). And the Theory of Distributions stood as proof of all this.

Schwartz’s pedagogical innovation, which I alluded to earlier, was as follows: he would pronounce the terms of a theorem or the proof of a

proposition, then he would pause, put down his chalk, look around the lecture hall, and remain silent for a while.

At that moment, our attention was inevitably drawn by the orator's physical particularities, which, given the effort of concentration since the beginning of the lecture, we had managed to forget: he was afflicted by a facial tic, which resulted in a tetanus-like contraction of his cheek (before instantly rising toward the heavens, affecting the rest of his face as it went, and creating the impression that he had winked) and which gave him rather a satanic look. (Lusson, who was more assiduous than I was at the "emempee" at the time, has reminded me that he also had another tic (unless it was the same one having an effect far lower down), which flung his shoulder upward in his jacket, thus creating the impression (in Pierre's words—I take absolutely no responsibility for them) that he was shrugging up a bra strap that had unexpectedly slipped down (→ § 41)).

Silence fell in the lecture hall, pens and pencils stopped running over the pages of exercise books. "So," he would say, "is this right or wrong?" Or else: "Is this proof correct or incorrect?" The audience held its breath. "Very well," Schwartz would say, "then let's vote on it! Will all the 'yeses' raise their hands?" His twitch became more pronounced. His eyes sparkled.

39 (§ 36 continued, part 3) **The vast majority of those present always voted for the wrong answer**

And the vast majority of those present always voted for the wrong answer (the behavior of the little community of the lecture hall confirming a little more each time (like the characters in Kipling's short story "The Village that Voted the Earth was Flat") that the noble discipline of

mathematics has nothing to do with democracy). The only, and sparse, exceptions to this rule belonged to one of the following four categories of students:

- a) those who had voted blindly and been favored by good fortune;
- b) those who already knew the right answer;
- c) those who had worked out the right answer, without knowing it

before then;

– d) and finally, those who had already been “taken” in the past by answering the same as everyone else, obeying their spontaneous judgment, but had since noted that the majority were always wrong, thus concluding that the truth must lie on the other side. (Category b didn’t boast many members, and category c even fewer.)

(I am not counting those who did not answer

- either because they hadn’t listened to the question, or
- because they didn’t feel capable of making any such pronouncement

(this was generally my position, which confirmed my impression, if confirmation were needed, that I would have to start studying the foundations seriously, so as to acquire not only a certain amount of basic knowledge, but also, and above all, the elementary mechanisms of axiomatic reasoning).)

But why was the majority’s answer always wrong? (And it was essential to Schwartz’s demonstration (not the mathematical proof (the result in question wasn’t necessarily an important one), but his pedagogical approach) that the lecture hall got it wrong; which meant that each vote was a triumphant demonstration of his lion tamer’s art

(because it doesn’t take much for such a crowd, which is generally attentive, admiring, and sheeplike, but which has also received the master’s lash on a number of occasions (because once a result or proof that satis-

fied Schwartz had finally been obtained, he never failed to go back over it, sarcastically highlighting all the elementary errors of reasoning and examples of just plain ignorance that had led us to the wrong answer), to change into a mob of unruly beasts)).

#### 40 (§ 36 continued, part 4) **This was thanks to the conjunction of two factors**

This was, I think, thanks to the conjunction of two factors: firstly, given these conditions (Schwartz's position of Professor, standing in front of his students, and students of this particular type: in other words, interested, not too knowledgeable, but not too dumb either, or too distrustful), the force of his conviction was enormous.

He seemed, and was (let's not mince words), stunningly intelligent (and the effect of this was intensified, if anything, by the involuntary winks caused by his tic); also, he knew what he was talking about, which obviously helped; and then, he knew that he knew (which also helps, when it comes to having force of conviction). (The phrase he used when talking about André Weil, and which he had, I think, coined, could as easily have applied to himself: "He doesn't take himself for the fool that he isn't.")

Secondly, he was careful (which was real proof of his profound experience) to choose cases where the normal reaction of any unwitting mind would be to give the wrong answer. Such situations were traps: counter-intuitive snares, mistaken generalizations based on past experience or on highly restricted examples

(even well-known mathematicians fell into these traps; even Mathematics itself (as represented by the consensus of its most eminent prac-

tioners) took a fall at certain moments in its history (such instances can be seen in the notes, glosses, or historical preambles of books dealing with a given theory, beginning with sentences like: “It was long thought, and even until recently, that . . .”).

Schwartz wanted to teach us to be prudent, to give our demonstrative mechanisms a good going over before opening our mouths, and to adopt the discipline of the axiomatic method.

(Some time later, when I finally came to grips with Bourbaki, I discovered that the examples Schwartz chose were to be found at those moments in the progression of theories that the Treatise signposted as being “danger bends” (“some passages in the text are designed to forewarn the reader against serious errors”); and retrospectively I understood better what he was trying to achieve with his dramatic stagings, which, once the fascination had worn off (in other words, when we’d left the lecture hall) I often found rather “histrionic”).

**41 (§ 38) another tic, which flung his shoulder upward in his jacket, thus creating the impression that he was shrugging up a bra strap that had unexpectedly slipped down**

This recollection, which I have just garnered from Pierre Lusson on the telephone, during one of our many conversations of this sort

(often complicated by the fact that Pierre, who is always at the cutting-edge of technological progress, has acquired a cordless phone so that he can answer it anywhere in his apartment, but regularly forgets to recharge the battery, so that his voice tends to vanish abruptly into an unexpected pit of silence, which I notice only after finishing my most recent sentence, with the result that when the conversation is resumed after a



dash back to the distant “base” (a dash that the purchase of this cordless apparatus was supposed to render unnecessary), his answer, of course, fails to take into account the words I have just uttered into the void, and instead continues along the lines of his previous train of thought, which I have since forgotten), combined with the daring and rather arbitrary comparison of this shoulder’s involuntary movement with another gesture (which we can sometimes observe with a twinge of emotion in an attractive young woman (supposing she uses this form of support)),

has just modified the image of Schwartz, of Schwartz in 1955 in the lecture hall of the MMP, which I had preserved (or reconstituted), and which appeared intermittently before my inner eye as we conversed, thus providing a certain mobility to the physique of this famous mathematician, whose face had—up to then—been all I could see, rather like a witness adding some new detail to a police sketch.

(It was during this same conversation that I had the misfortune to make, involuntarily, Izumi, Pierre’s barely eight-month-old granddaughter, offspring of Mathieu and Yuka, burst into tears; Pierre had given her the receiver so that I could talk to her, and I made a few mewling noises, as usual, whose discordances must have scared her (she’s used to being surrounded by excellent music) (scared, or else simply disappointed her; her parents, who are both viol players, are away at the moment, and she must have been hoping to recognize her mother’s voice over the phone, and was thus put out by my inept and unexpected sounds; I’m going to have problems getting over this). (Her voice and tears formed a rather striking counterpoint to our discussion of the old days—circumstances that have been dead and gone for quite a large number of days).)

These forgotten, characteristic gestures of someone we had seen a lot of at the time (and continued to see during the following years, but al-



most never since then), which had remained present and immediately accessible in Pierre's memory, while they had utterly vanished from mine (and I also have the impression that he remembers correctly, I too can now recall that movement, **I can see it**), have now been transferred to other images from that period, in which Schwartz appears, and I can no longer disassociate them;

as if the modification of the first image, the one of him by the board in the lecture hall, turning round toward us—by summoning up simultaneously, instantly (and irreversibly), all the others that I have at my disposal (in the corridors of the IHP, in public meetings at the time of the Algerian War . . .)—had convinced me that this was no simple emendation of an oversight, and that the revised image had always been there, as the “genuine,” “original” version in my own mind. (To put it yet another way: it was just as though I had a sort of dictionary of my images of the past, which my memory often reproduced imperfectly for the purposes of this narrative, and Lusson's remark had run this memory text through a “spell check”; the word (or image), which had previously been marked “not in dictionary” (here I am using the terminology of my “word processor,” Word 5), was now corrected, and not by the command that only alters the one instance of the word then on your screen, but by the one called “change all,” i.e., throughout the entire “text” of my memory.)

**42 (§ 30) a source of serious conflicts, in which everyone in my mathematical “generation” became more or less directly embroiled**

The common destiny of the students in the Integral and Differential Calculus “amphi” was still to take the still-prestigious *agrégation*, which would be the culmination of their studies (by repeating “still,” I am not

so much approving of the old-world viewpoint always lamenting “falling standards” when it comes to the intellectual level of this examination, but instead the indisputable “falling standards” in the social status of the teaching profession). If and when they passed this exam, then the doors of a teaching career would be opened to them, and the carrot of teaching “prep classes” (reserved for the most efficient and hardworking) would be dangled in front of their concupiscent noses (in such El Dorados, which meant taking on the working hours of a conscientious junior doctor in a hospital, one could earn a reasonable living (according to the extremely modest standards of the Fourth Republic (and a very good living, in fact, if, like the famous authors “Commissaire and Cag-nac” you managed to break into the “textbook” market))); while only a few (indeed, very few, and being a *Normalien* was almost a prerequisite) would reach university posts.

But there was now a snag: during that first year, but also the subsequent ones, the students of Choquet, Schwarz, and so on felt that an unexpected obstacle had just been added to the intrinsic difficulty of those entrance exams for the positions doled out so thriftily by the Ministry of Finance, working hand-in-hand with the Ministry of Education (at this point in time, no one had yet realized (because those who were pointing out this fact were ignored) that we were about to witness a school population explosion, and thus for some time an exponential increase in the need for teachers at all levels of education).

In some places (the Institut Henri Poincaré, the rue d’Ulm, and two or three islets in the provinces) the very nature of the “things” being taught as mathematics had utterly changed. But the same did not apply to the *agrégation*. Neither the program nor the attitudes of its judges had shifted an inch. Candidates of a modernist or “Bourbakist” ten-

gency risked being thrown against a wall that they would be incapable of scaling.

The *Normaliens*, whose abilities had already been amply proved simply on account of their having passed the entrance exam to their school, didn't worry too much about this exam; but for those who wanted to go further, and who now felt attracted to doing research into areas that had suddenly become even more fascinating (who also knew, or sensed, that university teaching posts, or full-time research work with the CNRS, would soon become far more accessible), they now had to put up with a waste of their time as well as risk an intellectual scandal. Thus, here were united all the necessary ingredients for an initial wave of what would be called, more than ten years later and in a far more extreme context, contestation. For the first time (?) in France, the content and the methods (the famous "lessons" for the oral exams of the *agrégation* were seen in entirely different lights by the "modernists" and by the "classicists") of an entrance examination were being openly criticized by its candidates.

Some refused to take it (this gesture, of course, had little effect in the case of ordinary students, because the judges were unaware of what had happened, and the only real result was to give the other candidates a better chance of passing; but for *Normaliens* it caused a genuine scandal (and for them it meant taking a serious risk)). Some even went so far as to make their contestations in front of the jury itself: so it was that Philippe Courrège took the written paper, passed it, and then explained, with a certain vehemence, why he rejected the very conception of mathematics as it was presented in the exams he was currently being made to endure, before announcing his refusal to continue. As for me, given that I detest exams, and especially those of the entrance variety, I quite simply did not study for it.

This movement gained momentum and, in the end (though much, much later) won the day. It is said (and if this isn't true, then it should be) that during the last days of the old order of the *agrégation*, before its complete reformulation on “modern” foundations, the administration of the Ecole Normale Supérieure, being faced with a refusal that included almost all of the students in the year (thus reflecting a far clearer contestation against the “elitist” nature of such exams, which had not been present at the beginning of the movement) (note that taking the *agrégation* was obligatory for students at the ENS), came up with an absolutely sublime response: the “best” five students in the year (i.e., those who had gained the first five places in the initial ENS entrance exam) were allowed not to take the examination.

#### 43 (§ 30) at “Plantin,” the café at the corner of rue d’Ulm and rue Lhomond

The café “Plantin” presided over the corner of rues Lhomond/Ulm. The tense of that verb has not been chosen by chance. If I had chosen another verb, *x*, I would have written *x-ed*; meaning that if “Café Plantin” had once *x-ed*, then today it no longer *x-s*. Even if, on progressing from being the bar it began as, in our day, to being a proper café, the establishment in question had kept (or adopted) the name of its now prosperous owner (who has had the time to die several times over since then, it was so long ago!); even if prosperity had led him to expand by buying up similar businesses, then spreading these like clones across Paris, thus heading a chain of imitation-bars, like the so-called “Batofils” which are to real bars what the “Fournils de Pierre” are to real bakeries (while fooling no one, except those who have never experienced a real bar (in other

words, more and more, for obvious reasons, practically everyone), nor a real bakery, given that the bars that aren't imitation-bars in "chains" and the bakeries that aren't imitation-bakeries in "chains" all now imitate the imitation-bars in "chains" (and likewise, respectively, the imitation-bakeries in "chains")) (I dare not even use the word *ersatz*, which has also disappeared; just imagine, the Occupation has been over for a good fifty years now!), and even if the "chain," first as a family concern, then a multinational one, had been sold for a small fortune just at the right moment by the heirs of its founder, "Père Plantin," but still retained the site of the original, the first "Plantin" (despite its reduced profitability after the transfer of the IHP), the thing that would currently be found at the very same corner of rues Lhomond/Ulm would not be what I am here terming "Plantin."

Père Plantin presided over his bar, which presided over the Lhomond/Ulm street corner. The verb I have chosen is not any old *x*, but "preside." It is an obvious choice. rue Pierre-et-Marie-Curie had no bars; rue d'Ulm had no bars in eyeshot either. If we emerged, as we did, on this side of the Institut Henri-Poincaré (for doing so on the other side would have meant fraternizing with the Spanish and Geography students in the cafés on rue Saint-Jacques, which was out of the question), we had no choice. Café Plantin had a hegemony.

We swamped it, adopted it, colonized it. And, to us, the owner, the above-mentioned Père Plantin, was himself the bar (we said "bar" for the owner as well as the place, just as we used the name of the bar (that is, the bar's owner) for the bar (the place), with a sort of metonymy that seemed natural, just as General de Gaulle was a metonym for France, or more accurately perhaps like the aristocrats of yesteryear who stripped themselves of any excessive individuality by calling one another by the

names of their estates, when between equals). Back then, hundreds of such bars were produced, all with the same Auvergne plumpness, moustache, and joviality.

But Plantin's joviality was severely put to the test by this abrupt invasion of penniless students who crowded into his tiny premises, thus scaring away his tiny traditional clientele of wine and coal merchants, sustaining themselves on little glasses of cheap white wine on a zinc counter worthy of the *Compagnie des Zincs*, which has been definitively reconstituted-evoked-resuscitated-described-photographed in that book Caradec and Doisneau collaborated on, while scaring him too with their incomprehensible conversations, agitation, and flagrant lack of monetary resources; scaring him, but not chasing him away.

For he soon came to the conclusion that he had better give up serving a few glasses of not-very-good not-very-pricey, "dry white" and instead sell a lot of lemonade and "coffee" (the inverted commas indicate the (considerable) distance between the drink he sold under that name and the one usually described as being coffee), which were hardly cheaper (the advantage of hegemony, indeed). He recovered the use of speech and smiled. Of course, some of us (and Lusson in particular) kept nagging at him about the poor value for money (as we did not put it) of his coffee, as well as about his manners and opinions, but he greeted all this sarcasm with resignation and tranquility (thanks to his hegemony, but likewise the conditioned reflex of the customer being always right, of course).

A very, very, very long time later, Pierre and I went back to the Café Plantin after a very, very, very long absence. He was still there, almost unchanged, a little whiter, a little fatter, a little grayer, but above all far, far more prosperous. The main room had been extended, rearranged, and repainted; there was a terrace, food was served, there were several



waiters and waitresses. Madame Plantin now refrained from operating the till. Père Plantin remembered Pierre well, and shook his hand for old time's sake (but he didn't recognize me, even though I had continued to frequent the IHP and his café for far longer, and still dropped by from time to time). And Pierre, who still often repeats, "Just think, we were the ones who made Père Plantin's fortune" (he even said it again just now, when I phoned him up to talk about it), said precisely that to the man and declined to pay for his drink. After a moment's managerial contemplation, Père Plantin smiled, and nodded.

**44 (§ 30) before passing the *agrégation*, which so pleased her father, who was a math teacher himself, but without this distinction**

She passed at the same time as Sylvia, in 1960 (the year of the birth of our daughter, Laurence, who's on the point of making me a grandfather). They had become friends.

We were all welcomed by her family with enormous kindness and culinary hospitality, which was doubly marvelous for its exoticism and its excellence. It would be hard to imagine today the sort of meals served in the university restaurants that we frequented, such as the Franco-Lebanese place just opposite Café Plantin (I haven't even experienced worse in what are generally considered the worst places to eat of all (I'm not talking about prisons), that is, the messes for second-class soldiers in the French army).

Her father, Mr. Espiand, was tall, stocky, chatty, and merry, while Mrs. Espiand was welcoming and gentle. Her masterpiece was *colombo*, around which we would sit chattering and stuffing ourselves enthusiastically and gracefully (I also remember the similar, Haitian version, "peas and rice,"



which René Depestre used to concoct in my parents' kitchen on rue Jean-Menans, just by the Buttes-Chaumont, when he was hiding out there as a revolutionary, unwelcome to both the Magloire dictatorship and the French authorities of 1950). The very name of the dish (far more attractive than "peas and rice"), which sounded like a concoction made up of tasty, pacifist birds (Picasso's *colombe*, from the controversial Stockholm Appeal, issued right in the middle of the Cold War, was still a lingering memory and recurrent image, even ten years later), whetted our appetites.

At the table, Mr. Espiand sat Sylvia and his daughter Marcelle on either side of him, joking with them all the while. He was very proud of his daughter, and very proud of her friendship with us, and with Sylvia. The mathematics we spoke about were not the same as his, and the university teaching that we had just taken up (this was in 1960, Pierre and I were assistants at the University of Science at Rennes) was admirable, but distant.

For him, the real consecration was the *agrégation*. It had been the unreachable horizon of his own past ambitions, which had now been redirected onto his daughter (the fact that he was Guadeloupian only made that abandoned desire all the more ardent, as it was being brought back to life but also renewed with added daring (a young woman was now attempting the same feat)). It had been his dream for Marcelle, and when she passed, his joy was immense.

For the occasion, there was a large colombo, a hyper-colombo, the colombo of all colombos (and the last, alas, of those colombos). Mr. Espiand not only had the delight of having two beautiful young women by his side, but also the long-anticipated delight, now fully savored in that perfect context of family, friends, and good cooking, to address them as "my colleagues."

45 (§ 30) **she would surely have excelled in the combinatorics of heavenly motion, if only she had allowed herself to want to**

Marcelle calculated remarkably quickly and accurately. She had a real taste for celestial mechanics, and was quite at ease with trajectories, “Lagrange’s equations,” and “Hamiltonians” (which I had the greatest difficulty in swallowing).

Our studies were now over, for better or for worse. For the reasons I have set forth in this chapter, I was behind all the others; and yet, like Pierre the year before (and thanks to him), I found an opening as an assistant in a university. At that time, the doors of the science universities had been flung open before the flood of students and, in the case of mathematics, as the very nature of the subject to be taught had changed radically, very few people were capable of taking up the posts that were becoming vacant all over the country. The *Normaliens*, for whom higher education had always been a happy hunting ground, were not numerous enough. “Head-hunters” from provincial colleges haunted the corridors of the IHP trying to convince those of its students who had not yet been tempted by more lucrative careers (which were also opening up in the semi-public sector, as well as, miraculously, in the private one) to take jobs with them as teaching assistants. We were extremely badly paid, but this was “higher education”; what’s more, we were going to be able to preach the Bourbaki gospel.

It was under similar circumstances, through a chance meeting in the same corridor we had haunted for several years, that Marcelle was offered a post in Montpellier. She turned it down.

I write: “She turned it down,” and I suddenly want to cry. As if Marcelle hasn’t been dead for almost twenty years now, as if I hadn’t mourned for

her, as if writing these sentences down on this paper of the future might somehow cast an offensive specter over her death. Even though I repeat to myself that it's absurd to say that if she had gone to Montpellier, she wouldn't have done this or that, would not in fact have ended her life so tragically, prematurely, terribly, I still cannot stop myself from doing so.

There were several possible reasons for her refusal: an unjustified but deep-seated feeling, sometimes concealed, but irrepressible, that she was not up to the task, and didn't have the right to be up to such a task. The reasons for this feeling, I mean the reasons that can be ascribed to social pressure, are so obvious that there is no need to state them. There was also (which is not unconnected from what happened later in her life) a sentimental reason, which I shall not divulge (at least, not in this branch. I do not allow myself to "tell all," and I choose not to say what doesn't enter directly into the path I have traced out. Though the borderline here is hazy, of course).

Marcelle obtained a post in a lycée, in Digne. She sometimes came to see us, Sylvia (who was teaching in Paris), and especially baby Laurence (I had by then been "drafted"). They used to have a good laugh about the shocking impression she'd made in the highest class of the lycée in Digne, elem-math, on first, the students, then on those Lower-Alpine students' parents, by being a new teacher who was 1) female and 2) (let's say it just as they thought it) a nigger. The notion of mixed-race schools had barely been accepted in that town in the first place (where my mother's mother had obtained after a long struggle the right for her daughter to take her leaving certificate), and now they were being plagued by terrible "culture shock." But the counter-shock must have been extremely hard for Marcelle. She reacted by accentuating certain sides of her character (I should really say: in that she didn't try to eliminate them), which could

only have further increased her charges' horror: she would arrive briskly in the classroom with her hand on her back and say: "Shit, my fucking bra-strap's just gone and popped!" She played bridge with her pupils, danced with them in the town's nightclubs on Sunday nights, then gave them tests on Monday mornings to wake them up. She was an excellent math teacher, without the slightest timidity. No one ever caused trouble in her classes.

46 (§ 32) **He clearly saw himself as a craftsman, a maker, a *fabbro* of deductions,**

Adopting the posture of a craftsman, in the old sense of the term—a cobbler, carpenter, or blacksmith—and treating the language of mathematics as a material, to be worked on metaphorically with your hands, was both a prudent and proud way for Philippe to claim a place among mathematicians: a venerable metaphor. Dante used it to describe Arnaut Daniel as the "best worker in his mother tongue" (Provençal); before him, the first of the troubadours Guillaume IX, spoke of his *obrador* (or "workshop"). And isn't mathematics the mother tongue of mathematicians?

But it is not an easy position to maintain. Mathematics, more than art in general and especially the arts of language, is shot through with the doctrine of inspiration. Of course, mathematicians do not say, "Strike thy heart! Genius lies there!" nor "It came to me one night, while listening to a nightingale!" That is not how this austere community expresses itself.

However, there is still a general notion that the great ideas and demonstrations that have marked the discipline's history were not the fruit of labor, but of an indefinable gift and quality of mind that distinguish such discoverers from we mortals, raising them to the status of inexpli-

cable phenomena. There are frequent comparisons between Gauss and Mozart, or Galois and Rimbaud (assuming they've heard of the latter, naturally). (→ Bif. A, in which I set myself at a certain distance from the most extreme version of this opinion.)

In such conditions, it's difficult for those of us who are aware that they don't have this gift, and yet do not want to content themselves by being nothing more than followers, or "minor talents" thriving in the shadow of greater ones (or those presumed as such) while lording it over talents even meaner than their own—for those of us, that is, who have a certain intellectual ambition, which was certainly Philippe's case, to acquire even a meager right to legitimacy, especially in their own eyes.

But the Bourbakist approach opened the possibility of establishing a reputation in a field that was still fallow, not yet overgrown by the weeds of intuition and the lack of rigor, and so to choose the right seeds for your theoretical farmland (structures and axioms), then plough, sow, strive, pluck out the unwanted weeds of error, before harvesting the fruit of one's labor in the form of a crop of definitions, lemmas, propositions, theorems, and corollaries, trussed up in beautiful bunches and bouquets of blooms (the corollaries, of course, as *ikebana* stylistically arranged according to the same patterns) (my mixture of agricultural and floral metaphors here is one often used by commentators); this is what the example of Bourbaki seemed to make possible.

Genius or not, by the axiomatic method, you should obtain, if not some spectacular results, then at least conceptual clarity without which, given the state of maturity that mathematics had now patently reached, other people's virtuosity, intuition, flashes of brilliance, and even genius were now doomed to sterility, and even to dead-ends and error.

47 (§ 34) the description, begun here, of the preliminaries to an intellectual adventure: my own

Let us use a metaphor, by accepting the hint contained in the word “adventure.” At a certain point in time (I have already talked at length about this “point” in the first branch of this work, but as a point that was in some way “floating,” without fixing it clearly, chronologically or geographically, in my own time, as experienced linearly (which is not the sole way to experience time; memory and forgetting, anticipation and regret provide different ways of grasping it)),

at a certain point in time, I gave myself an exploratory objective, a far-off pole that was difficult if not impossible to attain, and then set about trying to reach it. Let us imagine, using the same metaphor, that nearing this pole was like a journey. I spent years, many years, preparing for that expedition. Then, at a certain moment, I abandoned it. All this, this prose, comes afterward.

The aim of the adventure was primarily a **Project**, a Project of Mathematics and of poetry. What mathematics? I can’t really reply because, still sticking to my metaphor of an exploratory journey, it was at the pole that I never reached. At most, I succeeded in imagining what it could have been (what I might have found, had I traveled that far). What am I writing, or describing here? The preparations, and the material of my imaginings.

The **Project** was also (and above all) a Project of Poetry. The same question might be asked here: what poetry? And I must answer in the same way, if I can; though this will be dealt with in the next branch. And then, I also wanted to accompany my journey toward the pole of the **Project** with its shadow, a narrative (to put it simply), which would have been a novel, and its title would have been **The Great Fire of London**.



I did not write this novel, because I did not make the journey, because I abandoned the **Project**. Of this novel, there remain some drafts and sketches (as ever, the preparations for the expedition) and imaginings, or anticipations of what it might have been when it had been completed, at the same time as the **Project**, if the **Project** had been accomplished. What sort of novel would it have been? I cannot reply, except in the same way as I have for mathematics and poetry.

Having set about recounting this journey (now imaginary, since it never came to fruition), under the general title “**the great fire of London**” (lowercase and in “”) (though this is not all that I am recounting because I have several simultaneous aims (the tale of my preparations for the adventure of the **Project** and for its novel being only one of them), especially given the fact that the constraint of non-preparation that I have given myself for writing (precisely the opposite of the situation in which I was meant to carry out the **Project**, for which I never got past the preparation stage), means that I cannot know, even if I think I do, if there is an aim for all these aims, and if so, what it is), I was in any case obliged to examine my experience of mathematics. And this is what I am doing, or at least have started doing, in this branch three.

48 (§ 34) **Pierre would at once make several further, instantaneous leaps; he used to seize upon the reasoning of others, just as their sentences were being born, and finish these first**

We live in the future perfect (but also the “past posterior,” a tense with no linguistic reality, but which is conceptually symmetric). Our present is never, and it never has the time to be; it is already no more; we live it only as what will be the past, what will have been the past (and as what was

going to cease being the future). The constantly renewed memory of this state of affairs (or its constantly reborn prescience) as soon as life, other people, or language impose this inevitable play on us, leaves traces above all on words, our words, in the verbal particularities that characterize an individual, just like the shape of a nose.

The characteristics of Pierre L. that I am describing are an example. But this sense of the present has other ways of manifesting itself. Over time, I have collected other examples; or to put it more precisely, from the verbal particularities of several people I know or have known, I have over time put together such a collection, firstly employing a “collectivizing relation” (as Bourbaki would say—it was now or never, in an interpolation into this chapter, if I wanted to use this term) which was purely descriptive, before now finding (and when I say now, it’s really the “now” of my involvement in this nocturnal morning of prose (it is four forty A.M.) as I write), a more “theoretical” justification for it (the thesis that the present is definable only in the future perfect (in countless futures perfect and pasts posterior) than was announced initially).

I shall provide four examples (and only four, for numerological reasons). Of the four, the first example is:

– the late lamented Jean Queval, of the Oulipo, and one of its founding members. It can be said that Jean Queval never finished his sentences (I insist on this “can be said,” as I was never sure, to my complete satisfaction, if his sentences were indeed unfinished); firstly, because Jean Queval’s idea of what constituted a sentence was absolutely unclear to his interlocutors (in its beginnings, middles, constructions, and ends); secondly, because his sentences were practically inaudible, since he spoke them extremely rapidly, interspersed with rather indistinct horselike “hums” (as though a Swiftian “Houyhnhnm,” buried inside, was constantly trying to speak for him) placed such that they cut up the main

clauses (not to mention the subordinate clauses) in syntactically varied ways. He then proceeded at once with other sentences, these having no discernable connection with the preceding one (which people were still attempting to understand). And the reason for this incompleteness, which “falls,” as Frege would say, under the concept of present-as-anticipation, was his extreme modesty. Having started a sentence, he felt that the idea it was about to express was so banal that concluding it would, in fact, have been an insult to those listening. (This example deserves a far deeper elucidation. (It will have one, if I compose, as I hope I will, branch five of my work (in which François Le Lionnais will also be found once more, who puts in an appearance in these pages during Bifurcation A).))

– As my second example, I shall take an old friend of my father’s, Guy Harnois, who was one of his college friends from the Ecole Normale Supérieure (I have said a few words about him in branch two). Harnois’s sentences were also incomprehensible, and also because of their incompleteness. But the reason this time was his speed of anticipation. His thoughts moved so quickly toward their consequences and developments that he was literally incapable of expressing them without losing the thread. The incompleteness of his sentences was thus more like a short-circuit, or an ellipse, or even the superposition of several ellipses, and everyone who listened to him sensed how terribly slow their own thought processes were in comparison. I must acknowledge that he was particularly unfinished, hurried, and elliptic when speaking with my father, because they knew and understood each other well, using half words, or even the tenths of words.

– My third example is my friend Florence Delay. I have observed in her, but only episodically (in spoken contexts I will not specify here), similar breaks in the flow of her speech. They are particularly striking because they are exceptions to the rule, given that she generally expresses herself with

great elegance and clarity, both in her choice of words and in her diction. The reason (or my “theorization” of it, based on my thesis) for these breaks is that, as with Jean Queval, she is anticipating the degree of her listeners’ approval. But this time, the trigger of the interruption is not modesty (Florence isn’t particularly modest (nor immodest for that matter) and has no reason to be or want to be one or the other), but courtesy: Florence feels that finishing an ordinary sentence (in fact, they are not really “ordinary” sentences, but I must needs simplify) would be to waste the time of those men or women (men, mostly, as it happens) she is talking to, who have precious little of it (for listening to what other people have to say, that is).

– As for my mother, unlike the other three, she didn’t leave her sentences in suspension, or let them fade away, or mingle them with others. But, when responding to any affirmative statement to which she felt obliged to respond, she generally started with a word, just one, which expressed the precise opposite of what she was going to say: she would begin her sentence with “No . . .” and this “No” was not exactly the “no that means yes,” which is used quite often in spoken French and by which people show their approval of what they’ve just heard, but more precisely this same paradoxical “No” of approval being applied to her own statement, which had not yet emerged into the world of speech (and which, from her interlocutors’ point of view, could thus be interpreted as a genuine “no that means no”).

Marie, quite often, says nothing.

**49 (§ 35) his inability to submit to the strict rules of painstaking proof prevented him from attaining scientific glory**

For a long time, I thought that Pierre was a mathematician from another era, who had wandered into ours and was now confronted by an insur-

mountable obstacle placed in his path by the hierarchical and heavily institutionalized organization of knowledge (all knowledge) that became the norm at the very time when he was studying at university (it has grown even more rigid since). I am less sure about that now.

In his case, he could only have won his “right to mathematics” (in his own vision of how things turned out at the time and, so far as I can tell, how he still sees them now) if he had gone through the necessary act of initiation, which was to pass the entrance exam to the *Ecole Normale Supérieure*. But he had not done so. He thus did not have the right (institutionally) to be a mathematician. There were, under certain conditions, ways to make good this lack (for those, like Salem, who had long been occupied by other matters, (in Salem’s case, banking); or for those who had studied elsewhere, in Britain, Germany, or America. They could, in a pinch, be exempted from the initial exam).

(I say “in a pinch” because the text by André Weil, on which I comment in my first bifurcation, contains a “diatribe” against the American university system, which he sees as favoring the proliferation of mediocre PhDs, and it’s quite clear that he regrets the absence in the English-speaking world of a filter as effective as the ENS entrance exam, which separates once and for all the wheat from the chaff. This also explains why, in his opinion, a gift for mathematics must be revealed when the mathematician is young, etc. Many of the characteristics of the world of French mathematics derive from “axioms” of this sort.

(I’m not saying that the way things are done in the USA is better. It leads, from a different set of premises, to an organization of knowledge just as hierarchical and rigid as any other; and also more prone to a total absence of convictions.)

In any case, Pierre had taken this judgment on board. He struggled with himself, but was incapable of escaping from it. The battle had al-

ready been lost. He would not be a mathematician worthy of those he respected. Thus, there was no point trying to be a second-rank researcher. Thus, there was no point wearying himself in the making of one proof after another, except when it was an absolute necessity (like Nero Wolfe (another compulsive beer-drinker), he only allowed himself to be drawn into the chore of proving anything when there was no other way out).

All of this is quite probable. But, it still seems to me that his refusal of patience, of the demonstrative or arithmetical pains that, perhaps more than ever before in the history of mathematics, were required by total submission to the axiomatic method (which Pierre in fact praised with great persuasion), had roots that ran deeper than just the trauma of being excluded from the circle of *Normalien* initiates. At no time in a history lasting almost three thousand years has it been possible to avoid the often unpleasant and fiddly task of proving advanced results in presentations that are recognizable and acceptable to other mathematicians, even if the ways and means have changed over the centuries. It is true, and the “case” of René Thom, for example, proves it, that Pierre might have been able to find there (at the school) the necessary help to overcome his distaste. Yet, if this is so, then we are taken back to the preceding hypothesis.



The Great Currents of President Le Lionnais

50 (§ 6) **it was a sudden idea, an exhilarating, overwhelming, illuminating idea**

The idea of acquiring an understanding of the world through mathematics was certainly all of these things for me, but I owe the demanding mistress of my enterprise veracity and an admission that the idea was not entirely new.

(By “owing veracity” I mean the overpowering maxim that governs my own attitude to my narrative. It affirms its own veracity. Veracity is one of its maxims. But the maxim and the axiom must not be confused; the declaration of the axiom is only worth what all such declarations are worth, in other words just what credit the reader is willing to give to it; as for the maxim, is it valid only for me and, once again, any reader who encounters it may or may not trust me on this point.)

I must now go back a few years, to the fall and winter of 1948 when I had just turned sixteen, and to the reading of a book (in fact, a special issue of a magazine, but as ample in this edition as a proper book): *Great Currents of Mathematical Thought*, by François Le Lionnais, edited by and published in the pages of *Les Cahiers du Sud*, thus benefiting from great authority in my eyes as a reader, because this was a poetry review associated with a certain Joë Bousquet.

(I shall go into further detail about this fortuitous encounter elsewhere, and its implications (it will be part of another branch of this family of books, probably the fourth, according to my present intentions for the future (which will not necessarily be respected (another axiom of my narrative covers the absolute fluidity of its subsequent developments, the absence of any plan, and the refusal to be tied down by the slightest affirmation about its future; thanks to this axiom, I can make any number of predictions, their sole value being to illuminate the present moment of the narrative))).)

Given my age at the time, this wasn't a book likely to encourage a mathematical vocation. Most of it must have gone over my head. If one work did play a decisive role, then it may well have been the French translation of Eric Temple Bell's *Men of Mathematics* (consulted so many times in the Bibliothèque Nationale that it is now "out of circulation"). I read it, too, during that same academic year.

It was a year of semi-relaxation before going up to university: my parents thought that I was too young for such an ordeal, though I had already passed what was then called the "philosophy" part of the Baccalauréat in June 1948, at the age of fifteen. So it was that I remained at the Lycée in Saint-Germain-en-Laye where, without much applying myself, I worked on taking the so-called "elementary math" exams.

(I was really looking forward to going to Paris, to the Sorbonne, and in particular to being near the places where poetry "was," and so I got into a bit of a sulk.) In fact, I quite deliberately devoted the most of my time that year to poetry: above all I read the Surrealists, as well as their derivatives (involuntary, mediocre pastiches,

but perhaps not completely lacking in use; pastiches, as Proust recommended, are a necessary part of the development of writers, who must then free themselves from their influence, so as to be sure at least about what they are not going to do next).

So I read this large issue of *Les Cahiers du Sud* because of the review itself, which I admired with all my adolescent poetic exaltation, and just as much as for its subject, mathematics.

On reading it, it seemed to me a strange, difficult, and rather off-putting extension of Bell's book, even though it followed from it quite naturally; in particular when it came to the chapter about Cantor, which left me flabbergasted, because nothing in what I had been taught in my class at the Lycée in Saint-Germain-en-Laye had even hinted at the notion of the *transfinite*.

## **51 the eyes of the pupils and teachers of my school were turned towards glorious tomorrows**

(The eyes of all the pupils and teachers at my school were turned toward glorious tomorrows, preparation for the Polytechnique or the Ecole Normale, and were thus focused along a single line of convergence, leading to a horizon of conics and quadrics (like the eyes of the patriotic poet Paul Déroulède who, prior to 1914, were focused on the "blue line of the Vosges," which had been robbed of its white and red by the defeat in 1870) (or like Captain Hatteras heading for the pole).)

The idea of mathematical entities squeezing themselves into the land of numeric infinity (that umbilical limbo) stupefied me. I saw too that there were even several different kinds of infinity, which

was deeply disturbing; I can still see on the page those exhilarating and terrifying “alephs” that Cantor used to symbolize these majestic monsters.

See below, an aleph, the first member of the Cantorian family. See how beautiful, how inexorably beautiful it is (it’s well known that Cantor gave prestigious names to the members of his sacred college of “transfinites.” He called them ordinals and cardinals (trying to clothe them with a scrap (indirectly, through their names) of what was for him the immense prestige of the Catholic church (he even tried to have the orthodoxy of his conception of infinitely varied infinities recognized by an actual, serving cardinal))).

*(Here, the figure of an aleph.)*

As my level of mathematics wasn’t too high, I surely can’t have understood a great deal, either technically or philosophically, about most of the articles gathered together in François Le Lionnais’s “Great Currents.” I reread them after making my decision (I might even say, read them properly for the first time), when I set about making a systematic study of Bourbaki.

However, I shall now spend some time on a description of the content of this tome, though only in a limited way, which will have less to do with its intrinsic importance than with the future of my own book, not just because its place of publication (a poetry review) creates a connection, which is sufficiently contingent to stand as a narrative requirement, with one of its future branches, as stated above, but also, and for similar reasons, because I am now providing an anticipatory link with another

branch (the fifth, in this case), in which we will (may) get to know its author better.

**Description of Great Currents of Mathematical Thought: first moment.**

Circumstances – In his introduction to the volume, Jean Ballard, the director of *Les Cahiers du Sud*, wrote: “**François Le Lionnais** (who shall henceforth be called FLL throughout this description (pronounced <EFELLELLE> —J.R.)) *happened to be in Marseilles in 1942. Charmed by the extent and above all the clarity of his knowledge, I suggested that he should elicit explanations from the best mathematicians working today, and gather them together in a book that would present an overview of current mathematical research and thought. ( . . . ) Neither of us sought to conceal the difficulties of such an enterprise in 1942, but we were far from thinking that it would take five long years to complete.*”

The ambition of the initial project needed, of course, to be toned down because of the war: in particular, among those who should have been contacted for this project, some were “*exiled and lost to us.*” But the main reason for the delay was the arrest of FLL because of his involvement in the Resistance, and his deportation to Dora, after a brief incarceration at the prison of Fresnes

(where he spent his long hours of leisure writing a chess handbook for one of the warders, who was an avid player, and who secretly provided him with the paper he needed for this enterprise (the “mini-manual” in question was discovered in the archives of Fresnes and given back to him a few years after the Liberation)).

52 “Among the hopes that sustained him,” Ballard went on

*“Among the hopes that sustained him,” Ballard went on, “the ‘Great Currents’ project (which will henceforth be abbreviated as “Gr.C.” —J.R.) occupied his mind to such a degree that, one day, it nearly cost him his life. He had reconstituted the table of contents from memory. Some of the names, which were written on a piece of packing paper, came by chance into the possession of the warders . . .”*

Borel, Montel, de Broglie, Valiron, and Brunschvicg were, it was assumed, the names of FLL’s accomplices in a planned escape attempt. In punishment *“for the crime of having written on Third Reich paper with a Nazi pencil,”* FLL received *“a damn good beating.”*

I should like to add another point, which was not mentioned by Ballard and which I learned (as did other members of the Oulipo) from FLL himself: the Gr.C. acted as a “cover” for the President (the Founder-President of the Oulipo) for a different sort of activity: the Resistance.

In Dora, as the reader perhaps already knows (and if not will learn here), along with other members of his unit, FLL worked hard putting together from memory descriptions of some of their favorite paintings from the Louvre. After the Liberation, he described this survival exercise in a marvelous text: *La Peinture à Dora, Painting in Dora*;

which, being an experiment played out in the theater of memory, is presented in a way that evokes the tradition recovered by Frances Yates in her book, *The Art of Memory* (which Raymond Queneau caused to be translated then published by the Nouvelle Revue Française), where this lesson can be found (likewise illus-



trated by her biography of Giordano Bruno): the art of memory can become an art of survival.

(Painting in Dora is one of the few texts, along with books by Robert Antelme and Primo Levi, which have enabled me to gain what little understanding I have managed to acquire, since the age of twelve, of the incomprehensible horror of the Nazi “camps,” and of that sort of collective, limited, fragile, but real hope, which each of them tried to transmit, in their different ways, through their writing.)

Why this preamble? Because the Gr.C. will be a part of my portrait of FLL and, in terms of what I plan to say in my branch five, I am now laying down a few foundations.

Thus, the Gr.C. must not be understood simply in terms of its relationship to mathematics, and, indeed, the first points that I am going to make regarding my current rereading of the book do not concern that subject.

However, the orientation that FLL gave to his own approach to that discipline is highly relevant to the objective of my investigations in this my third branch.

### 53 Description of Great Currents of Mathematical Thought: second moment

#### Description of Great Currents of Mathematical Thought: second moment

#### The Gr.C. as the start of an infinite series—

So, the book was not completed until the beginning of 1948, and the table of contents reveals the not always harmonious co-

habitation of its states: the old and the new. A double layer of contributions appears: some are the residue of the initial project, others display the characteristics of mathematical thought immediately after the war.

But, so far as FLL was concerned, this state of affairs was in no way problematic. Forever looking restlessly ahead, he in fact considered this volume to be just the beginning.

There are numerous allusions to a “second series of articles”—p. 67: *“we shall make use of a second series of articles to introduce the [idea] of . . . metamathematics, which [has not been] given [its] proper importance in a sufficiently direct manner in this first series”*; p. 119: *“this topology to which we are eager to give the place it deserves”*; p. 225: *“The second series will include historical descriptions of the origins of mathematics and famous calculators”*; p. 305: *“We intend to go back over the twenty-three problems of Hilbert in the second series, and examine each one of them . . .”*).

What can be seen behind these allusions to a second volume of the Gr.C. (which, it must be pointed out, never came to be written)? What the first volume should have been, in reality, and what it might well have been (however doubtful it may seem, but the intention at least was there), if circumstances had not interrupted its completion.

When seen in this way, the Gr.C., which is in fact Gr.C. 1 (announcing a Gr.C. 2) is a monument from the period of rebuilding upon the ruins of the war (when people used to say: “Let’s roll up our sleeves, things will get even better!”), which was put together urgently, and only partly resembles the abandoned Gr.C. 0, with

the real project, which inspired Gr.C. 0, now put off to a date even farther in the future.

But like the first Gr.C., Gr.C. 0, as devised during those dark years, had already been to a large extent imaginary.

Furthermore, even if the project had been carried out as planned, it would have necessitated such an enormous number of corrections, additions, and updates (not to mention a volume of massive girth, which is implicit in what FLL revealed about his intentions), that no simple “second series,” published in the form of a Gr.C. 2, could possibly have sufficed; rather, a potentially infinite sequence of Gr.C.  $n$ ,  $n$  covering the entire set (at least) of natural numbers, would have been required.

Thus, the “real” Gr.C. project would have been a Gr.C. index omega, omega being the first transfinite Cantorian ordinal, and it would no doubt have included at least “aleph-zero” pages. (It could have been placed, like the Bible in the bedside tables of American hotels, in each of the rooms of the Hotel Hilbert (there are an infinite number of them; as is well known, this hotel can always “accommodate” a new, unexpected traveler, even when it’s full).)

#### **54 Those who knew President Le Lionnais will no doubt experience a certain feeling of déjà vu on reading this**

Those who knew President Le Lionnais will no doubt experience a certain feeling of déjà vu on reading this. For, in that extraordinary man’s career, the Gr.C. is by no means the sole example of his inaugurating such intellectual programs with the announcement of their continuation as a virtually infinite series of installments,

but which never progressed far beyond their initial stage, or even beyond a purely imaginative evocation.

(The readers of the first branches of “**the great fire of London**” will recognize that this notion is close to my heart.)

Herein lies one of the reasons why reading the Gr.C. (I mean Gr.C. 1, the only finished item in the series) creates such an overall impression of heterogeneity, making-do, and disparity. Disparity—the word has now been used, and deliberately so; it serves quite well as an overarching description of the President’s activities. It’s also the word he thought fitted them best, and which he claimed as an aesthetic concept that had (voluntarily, according to him) governed his entire existence.

He had even planned to publish his Memoirs under this title, and these Memoirs, based on the principle that has become clear from the analysis of the Gr.C. I’ve just made (that of a virtual series to be continually updated, obeying the constraints of completeness, consistency, and perfection, thus making even the first part difficult, if not impossible, to finish) would also have required a sizeable number of volumes

(the corollary of this existential “theorem” was a strategy of diversions, perpetual digressions, and revisions leading to new perspectives upon the subjects and episodes already covered.

It was, I think, this particularly discouraging aspect that finally forced Jean-Marc Levy-Leblond and his publisher (Le Seuil) to abandon this project though they had initially agreed to take it in hand).

(To look at the matter realistically, which FLL presumably did, these delays of course had no importance whatsoever. All that was necessary was to publish an appropriate number of pages as the

first volume in whichever series (while remaining ready to extend it to omega tomes); and then, thereafter, to publish a second volume, then a third, et cetera, each containing additions, corrections, and digressions concerning the previous ones (and no doubt for the succeeding ones too, which would already have been entirely mapped out in the imagination of their author's irrepressibly effervescent mind).)

(The exact title, suggested by FLL was *Le disparate*. (In using the article *le*, contrary to the opinion of every dictionary, FLL deferred to Marcel Proust as his authority; for example in the old edition of Proust's works in the Bibliothèque de la Pléiade we find (the underlining of the word *disparate* is mine), on p. 205: “. . . une accumulation de redites et un *disparate* d'étreennes”; p. 246 “. . . un *disparate* bizarre avait existé entre les satisfactions qu'il accordait à l'un et à l'autre”; p. 532 “Songeons seulement aux choquants *disparates* que nous présenterait . . . tel horoscope.”))

## 55 (third moment): of two Franco-French generations.

### Two Franco-French generations—

An examination of the contents of the Gr.C. reveals the cohabitation (and discordant clash) of two mathematical generations, who were, given the circumstances, almost all French. There are the great names of the “French school” of analysis, whose survivors made up the country's mathematical establishment at the end of the war: Borel, my old teacher Bouligand, Valiron (whose retirement meant that I narrowly avoided his tenure at the IHP (→ chap. 1)), Montel, Denjoy, Fréchet (with whom I spent some time in Grasse at “La Messuguière,” a sort of lodging house for

intellectuals of modest means; in 1955, he was an infinitely courteous old man). (Louis de Broglie and Le Corbusier are also included.)

Some of these names were the last survivors of a venerable generation of French mathematicians from before the First World War: some of them had known Poincaré; they had lived through that massacre, the trenches, and the gas; and thus, it would seem, they had earned the right to live to a ripe old age, as a sort of collective compensation decreed by fate.

I was one of their pupils, but only just. (For example, Bouligand was still teaching when I was a student because he had a large number of young mouths to feed. Thanks to them, he put off his retirement for as long as possible and continued professing geometry, even though his lessons were almost incomprehensible, and their incomprehensibility was aggravated by the fact that what was being taught elsewhere was already changing: the dawn of Modern Mathematics was breaking.)

There was also Hadamard, then almost a hundred, I think. He arrived every day, at the beginning of the afternoon, walking with the tiny steps of a little old man, and a little old man who had never been very tall, heading up to the library of the Institut Henri Poincaré; once arrived, he was handed a large mathematical textbook dating from his youth, a huge folio almost as big as he was and certainly heavier. He opened it with a deal of effort and read a few lines before falling asleep for an hour, then he woke up and went home just as he had arrived.

We watched him with amazement and tenderness. He had once been a truly great mathematician, as well as being an extremely



modest, courteous, and generous man, and we all hoped that he would live to celebrate his hundredth birthday. As I write this, I don't know if he actually lived to be a hundred.

Alongside them in the Gr.C., there are also some philosophers of mathematics. Among the "young generation," as seen from the perspective of today, can be found Jean-Toussaint Desanti, before he became embroiled in political turmoil (the now-ancient match between "Bourgeois" science and "Proletarian" science).

There is also Marcel Boll, who has been rather unjustly forgotten, though here he stands as the sole representative of the modern conception of logic and a dedicated disciple of the Vienna Circle. And finally, two members of the Resistance who died after deportation: Albert Lautman and Jean Cavallès.

However, the seat of honor was obviously (I say "obviously," but, at the time, this choice reflects a gamble taken by FLL which was not as "obvious" as all that) reserved for the French mathematical avant-garde, the Bourbaki school.

But Henri Cartan, the pedagogical cement of the group, so to speak, was absent, though indirectly present via his father, the venerable Elie Cartan (whose thesis dated back to 1894; at the time he was the only "ancient" to be explicitly approved of by the young iconoclasts (though the extremely disappointing memoirs of André Weil do contain (as belated remorse) a glowing eulogy of Hadamard (almost the only person to merit such praise))). (It must be said that the Bourbakists' youthfulness was a relative concept, given that the founders, such as Weil and Dieudonné, were around forty when the Gr.C. was published.)

## 56 The Gr.C. and Bourbaki

### The Gr.C. and Bourbaki—

At the time, “Bourbaki” was seen as a group of insolent, badly brought-up terrorists. In the Gr.C. there can of course be found some of those who kept the establishment going, such as Fortet and the Dubreils (husband and wife: Madame Dubreil, née Marie-Louise Jacotin, was the first woman who evaded the vigilance of the sexist authorities, having decided to take the entrance exam at rue d’Ulm in the science section and, benefiting from the fact that the regulations had nothing explicit forbidding her from doing so, overcame all efforts to exclude her, rulebook in hand, and passed it (her exploit would allow other “young ladies” to try their luck the following year, one of whom was my mother (→ branch two))).

Dubreil was an algebraist, who had studied under the great Van der Waerden, and had served in the Resistance. The Bourbakists, whose “pope” (who shall remain nameless (André Weil)) had spent the war years in the United States (and I can’t blame him for that), hated him for reasons that were not entirely theoretical (academic power was at stake).

(In these disputes, which always remained quite discreet (the university world required nothing else), there was something quite reminiscent of the great postwar literary quarrel that opposed, on the one hand, Aragon and Breton, and on the other, Péret (a stylistic parallel between Weil and Breton could also be explored).)

The very structure of the Gr.C. clearly shows that FLL was gambling (a bet which in 1948 was far from being a safe one) on them,

or on it (“Bourbaki” generally, either as a group or its members, or even their work, the Treatise, all three usages being considered interchangeable).

This can be seen in the organization of part two of the book, entitled “The Mathematical Epic”: it has a section called “The Past,” a section called “The Present,” then a section called “The Future.”

The future is represented by two texts (the first, by André Weil, is quite extraordinary when examined in detail (I shall come back to this), while the other, by Godement, one of the “young” Bourbakists, is perfectly forgettable in its mediocrity). Which is to say that “the future” was represented entirely by members of the group.

Furthermore, in the “present” section, an important place is given to Dieudonné on Hilbert, whose virtually divine status and example (thanks to his axiomatic method) had a decisive influence on Bourbaki (the last published text by Raymond Queneau, “The Foundations of Literature (after David Hilbert),” pays homage in his own, ironic way to The Foundations of Geometry (*Grundlagen der Geometrie*) by the very same Hilbert, an unsurpassable masterpiece of method). Finally, in the “past,” the only text of any real interest today is by Elie Cartan, on Sophus Lie, of course.

But that’s not all: in the first part of the volume, “The Temple of Mathematics,” after the obligatory nod toward old Borel (he who imposed the probably pointless task of rewriting the *Odyssey verbatim* to his unfortunate typing monkeys (yet more unwitting imitators of Pierre Menard)), who herein presented some rather philosophically trivial ideas about the definition of numbers, FLL immediately placed a text signed by Nicolas Bourbaki himself.

This was both a real first and an astonishing, never to be repeated exception to their general strategy of complete silence outside their Treatise (I often wondered how FLL managed to wheedle this out of them, but unfortunately I never took the opportunity to ask him).

### 57 **This text deserves particular attention.**

This text deserves particular attention. In it, Bourbaki calmly wields philosophical bludgeons of quite Neanderthal proportions, in contrast with his usual snakelike prudence.

In contrast, the introductions to Bourbaki's actual books and fascicles, taken as "historical notes," though teleologically conceived in order to create the feeling that, since the very origins of humanity, mathematics had been converging inevitably toward a single point (the world had been created to produce one book, and it was to be by Bourbaki), are far more strictly controlled and, by remaining resolutely "technical," generally escape from the most flagrant metaphysical snares.

On rereading this text, I noticed an extremely striking comparison. According to them, mathematics is like *"a great city whose suburbs never cease to grow in a somewhat chaotic fashion on the surrounding lands, while its center is periodically reconstructed, each time following a clearer plan and a more majestic arrangement, demolishing the old sections with their labyrinthine alleys in order to launch new avenues toward the periphery, always more direct, wider and more convenient."* (the Haussman-like dream of Bourbaki here shows its true colors),

all of which is closely comparable with a metaphor used by Wittgenstein in his *Philosophical Investigations* ( $\rightarrow$  § 18), but concerning language, which is described as being: ***“a maze of little streets and squares, of old and new houses, of houses with extensions from various periods, and all this surrounded by a multitude of new suburbs with straight and regular streets and uniform houses.”***

This similarity seems to me not entirely fortuitous: Wittgenstein’s concept of language games, which underlies this urban image, can be applied almost without revision to Bourbaki’s Treatise, because it was written using the axiomatic method, and also quite clearly illustrates an analogous idea, that of “family resemblances” between elements of a given set, which creates the inimitable “tone” of the group’s works.

As for FLL’s running commentary, which appears throughout the volume, it is written in what I would describe as his characteristic “mystery style.”

It is, in fact, quite similar to the style used by Eric Temple Bell in one of the first models of the genre, *Men of Mathematics*, an ambitious work of popular science, which François Le Lionnais knew well (the French translation came out in 1939). But the enigmatic nature of most of these texts is not necessarily off-putting to an adolescent or amateur, not yet possessing the technical means to understand them (and this applies all the more to readers of poetry).

You are made to sense the possibility of a marvelous future by being shown how marvelous the future was for the great mathematicians of the past, in hindsight, before they made their wonderful discoveries.

You are told: there have always been discoveries, and there always will be, and not simple repetition of the things that others have already found: you are offered a vision of the Holy Grail, the great hypotheses or conjectures that have resisted proof for centuries, Fermat's Last Theorem of course ( $\rightarrow$  Bif. B), or Goldbach's Conjecture (which states that all even numbers greater than two are the sum of two primes), to mention only two of those that can be explained in terms that are accessible after only a year or two of high school. And you are invited to contemplate and keep your eyes firmly fastened on these, just as Captain Hatteras, yes him again (he's one of my favorite heroes), in the Jules Verne novel keeps his stare focused on the fore of his ship, "his eyes obstinately fixed in the direction of the pole."

**58 Then, plunged for a long time into "real" mathematics, I forgot about the Gr.C.**

Then, plunged for a long time into "real" mathematics, I forgot about the Gr.C. I reread it (not entirely, but selectively) almost twenty years later when I was invited by Raymond Queneau to join the Oulipo and I met FLL in the fall of 1966.

By then, I had reached the end of my passion for Bourbaki, after being one of their most faithful and credulous readers for many years.

I was of course struck by the implicit Bourbakism of the Gr.C. (while not seeing how intrinsic a part it was of the book's architecture as clearly as I do today: this is something that I have only really identified now, from the far cooler perspective of this prose).



FLL and Queneau admired Bourbaki enormously, and knew several of its members personally. Twenty years after the Gr.C., FLL had acquired a wide-ranging knowledge of the international mathematics scene and was on letter-writing terms or otherwise in touch with many of its participants. But his way of being interested in mathematicians and their activities was quite particular.

He looked at them, I am sure of it, with the keen eye of a collector. He collected mathematicians and mathematical results (the former and the latter on the same level). And he continued doing so until the last years of his life, but without any real technique (he was horrified at the thought of making any technical effort: writing a literary or poetic text, proving a theorem, or actually playing a game of chess, what an inconceivable waste of time!)

He wanted to know, and he knew (in the sense he gave to the verb “to know”) what was happening in the world of mathematics, what had just been proved, or what was about to be, knew which were the most spectacular results produced by Russian mathematicians, Californian logicians (he had a soft spot for Julia Robinson), or Japanese algebraists, and most of all he knew the oddities, the occasionally stupefying singularities that can crop up in the provinces of mathematics, such as arithmetic, combinatorics, or logic.

He was constantly curious. Even his conversation shared the direct (or should I say broken) lineage of the Gr.C.: disparate and digressive.

I remember him speaking to me about the second series of the Gr.C., when I respectfully broached the subject (at the beginning of my time with the Oulipo), as if it were in progress and almost finished.

And I think that he hoped (or imagined he hoped) that he would indeed complete this work, until the last moment, but without ever doing very much about it, given the large number of even more pressing projects that held him back, which were responsible for even more unfinished tasks.

## 59 Description of The Great Currents of Mathematical Thought: final moments—André Weil and mathematical ethics

### André Weil and mathematical ethics—

The Gr.C. contains a quite astonishing text by André Weil, the pope of Bourbaki and a great mathematician honored by one and all (myself included), which I reread attentively and should now like to look at in more detail. In fact, it contains two mingled, but unarticulated, parts: the first part is strictly mathematical and totally incomprehensible, not only to almost all general readers, but also to a large percentage of mathematicians at the time

(it's a sort of informal description of the state of modern algebraic geometry, as well as of all the questions and concepts leading to what is known as Weil's conjectures, the resolution of which occupied a good part of the next generation of Bourbakists, and in particular the fabulous, legendary Alexandre Grothendieck).

In the other, introductory and concluding part of what is in fact quite a brief text, Weil turns to more general considerations, which could be summed up under the title "the morality of mathematicians in the modern era."

*"... while some sciences, through the almost unlimited power conferred on it by its arbitrary use, is currently becoming a caste*

*monopoly, a treasure jealously guarded under the seal of secrecy, which can only be fatal to all true scientific activity* (the target is physics at the time of the nuclear bomb and the start of the Cold War—J.R.), *mathematicians do not seem to be particularly exposed to the temptations of power or the straitjacket of official secrets: Mathematics, as G. H. Hardy said in his celebrated inaugural lecture, is a useless science. Meaning that it can contribute directly neither to the exploitation of our fellow men nor to their extermination*” (later on, some people really ought to have remembered that adverb “directly”).

*“It is certain that few men, in our era, are as completely free in the play of their intellect as the mathematician. If State ideologies may sometimes attack his person, they have thus far never attempted to judge his theorems; whenever mathematicians have tried to please a temporal power by forcing their colleagues to conform to some orthodoxy, all they have reaped as the fruit of their work is scorn.”*

This reflection about mathematicians, the world, and power expresses a forceful idea, a demand for independence, but at the same time it is either naïve or hypocritical; I think that this is quite clear today; but its consequences for the mathematicians being brought up with these convictions, which were likewise those of their teachers, were such that when they discovered the inevitable involvement of their science (their beautiful, irreproachable science!) in the military-political-financial magma of the 1960s, the conclusions they drew from this revelation led to an absolute rejection that was just as absurd as the noble, “clean pair of hands” position claimed by Weil.

In the same paragraph, Weil brusquely switches to another, far less fundamental idea, as though it were a corollary of his previous point: *“Let others haunt the antechambers of the mighty so as to be granted the costly apparatus without which their Nobel Prize will never follow: all a mathematician needs is a pencil and paper; if need be, he can even do without that. He doesn’t even have a Nobel Prize, the longed-for acquisition of which might turn his eyes away from a long-maturing project towards a brilliant, but ephemeral result.”*

This is a classic example of denial; and no, I’m not complaining about the fact that there is no Nobel Prize for Mathematics (which I would obviously have won, you know, because I am the greatest, the best, the be-all and end-all). (It shows to what an extent Weil and the Bourbakists (as is still the case, in fact, for almost all mathematicians) were pierced to the marrow by a conception of their discipline (by no means glimmering for the last time in Weil’s article, but instead being set down in one of its ultimate, naïvely revealing forms) that is, in the end, less aristocratic (a “populist” criticism that might, rather foolishly, be made of it) than problematic, I think, in that it is strictly individualistic while nonetheless being nourished by the same sort of aspirations cultivated by high-class athletes.)

*“All the world over, mathematics is taught, well or badly, and the exiled mathematician—and who nowadays can believe himself safe from exile—can always find a modest means to earn a crust anywhere, while continuing his work as best he can (look who’s talking!). Good mathematics can be done even in prison, if one has the necessary courage.”* (I want names!)

## 60 Logic is healthy for mathematicians

Logic is healthy for mathematicians, Weil goes on to say, in substance: but it isn't something that merits the slightest attention.

The word was chosen by design, and displays a high degree of scorn. We can only wonder how such a great mind could have got things so wrong. "Stupidity isn't my strong suit," as Paul Valéry put it, and Weil could easily have said something similar (though without the slightest hint of self-mockery). And yet, he remained utterly blind to the intrinsic mathematical importance of logic, which seems blatantly obvious to (nearly) everyone today.

Indeed, logic was one of the blind points of Bourbakism as a whole, and the entire history of the past forty years has proved Weil wrong.

Not only isn't it possible to limit the role of logic to a prophylactic, but the subsequent developments of mathematics (for example, the theory of categories) and of machines (the use of computers) have meant that its role has on the contrary greatly increased.

(I remember hearing Claude Chevalley say that there was now a gap between logic and mathematics that would grow ever wider, like the one that once split physics from mathematics, leaving them to become distinct sciences (this was a more honest way (if possible) to sideline logic).)

But all of this was already predictable at the time. So it isn't just a matter of an individual misunderstanding on the part of André Weil: the internal "logic" of the group, the idea that there existed a higher truth set apart for its members, thanks to the sole fact that

they were part of a circle of initiates (once elected), and then the resulting passion for intolerance and exclusion and their sectlike spirit—all of these were enough to create this sort of blindness.

Weil then moved onto a theory of great mathematicians, worthy of an encyclopedia salesman's unshakeable ideas about math and its servants: “. . . *it is not the sort of science that is nourished by details gleaned carefully over a long career, by patient reading or observation, by index cards piled up one by one to form a stack from which an idea will finally emerge. In mathematics, more perhaps than in other areas of knowledge, ideas burst out fully armed from the brains of their creators.*” (Which mathematicians, except in a pinch the Indian Ramanujan, could he have cited as not relying on centuries of patient, painstaking work before some “fully armed idea” burst out?) “*Thus, mathematical talent generally reveals itself at a young age; and the second rank of researchers plays a role that is even less vital than elsewhere, acting as a resonance chamber for sounds they have not contributed to making.*”

(Here, we recognize the tone of Charles de Gaulle: reinforcements are on their way.)

Two ideas are thus mixed together, one propping the other up:

i—All mathematicians (in the real sense of the term) are young (that is, there is such a thing as mathematical genius, or a gift, which owes very little to learning);

ii—(Therefore) there are no secondary researchers. You are the Chateaubriand of mathematics (born a Fermat, Gauss, Riemann, Hilbert, etc.), or nothing.



**61 These ideas clearly indicate an elitist conception of talent (the theory of a “gift”), but they are not necessarily where such a conception must lead**

These ideas clearly indicate an elitist conception of talent (the theory of a “gift”), but they are not necessarily where such a conception must lead, and I for one will not distance myself from that particular point of view (criticisms of elitism in this domain are as stupid as the ideas they condemn).

Instead, I should say that ideas like the above are simply their own special brand of absurdity, even though they are commonly accepted (first and foremost by the vast majority of mathematicians) without any discussion.

Of course, a touching and rather silly aspect of this position provides us with the spectacle of none other than Dieudonné, then barely fifty (the age at which you ceased to be an “active” member of Bourbaki, according to Weil’s axioms), putting himself “at the service” of the far younger Grothendieck so as to draft the EGA (or Elements of Algebraic Geometry: a sort of anticipatory branch of the *Treatise of Bourbaki*, dealing with a field that was still totally new and in explosive expansion (→ chap. 4)).

The ideas in question are merely received opinions (in fact quite recent ones), and they would have delighted Bouvard and Pécuchet (question: **how old was the inventor of the zero?**).

Above all, even if they were true, they would be quite irrelevant. Neither age nor time has anything to do with the matter.

Like in any other field, progress cannot be made in mathematics, and in mathematics perhaps even less than in any other field

(another received opinion states that mathematics is the field of absolute progress par excellence), without a mathematical community, without the accumulation of small, middling, and yet important results, obtained by small, middling, and yet important researchers. (The classification of finite groups fifteen years ago, and the proof of Fermat's theorem today (among others) strikingly refute Weil's position.)

As he draws close to the peroration (for the final pages of the text sound like a speech; let us say, rather wickedly, that it could easily have passed for a prize-giving speech at any high school at the time of the Third Republic, and that it displays the same approach to prose-writing, a stylistic ideal that Bourbaki and Weil himself were never to transcend), as the conclusion approaches, then, Weil's tone becomes suitably emotive, noble, and solemn:

*"If, like Panurge, we ask the oracle questions that are too indiscreet, the oracle will give us the same answer as Panurge received: Trinck! Mathematicians willingly obey this advice, satisfied in believing that they can quench their thirst at the very source of knowledge, satisfied that it will always surge up just as pure and abundant, while others must content themselves with the muddy streams of a sordid today. And if he is reproached for his haughty attitude, if he is pressed to take a stand, if he is asked why he stubbornly ascends glaciers where none of his fellows can follow, he replies like Jacobi: 'For the honor of the human spirit.'"*

The final phrase, a quotation from one of the "greats" of nineteenth-century German mathematics, summons up another, which is not in Weil's text, but which corresponds even more

closely to the spirit of the two ideas I have mentioned, and is an integral part of the Bourbakist morality: “The honor of mathematicians is to prove theorems.” (It has been used for many not very honorable purposes, for example on the hiring committees for university teachers.)

For the word honor, present in both quotations, has ended up taking on a narrower meaning for pragmatic reasons: honor does not consist in demonstrating theorems, period, but in proving theorems that are difficult, so difficult that others have failed in the task; thus, it is not a question of theorems that will be decisive in the development of a theory, but that become easy once the new direction in which their solutions will be found has been discovered. The only “honorable” problems are those that have caused everyone else to fail miserably. (There is a childish image behind all of this: the mathematician as a mountain climber reaching the heights of the Himalayas by climbing a supposedly impassable face, or else as a lady explorer reaching the North Pole on foot, in a bikini, with her hands tied behind her back.)

## **62 *The Great Currents* fascinate me today, seen as the sketched outline of a literary genre**

*The Great Currents* fascinate me today, seen as the sketched outline of a literary genre. In its final state, it occupies a unique position between middlebrow, popular books like Bell’s; those rare works by mathematicians, such as Polya or Hardy, which provide a non-technical but at the same time non-trivial view of mathematical discoveries; and finally those “progress reports” whose

purpose is to describe the most recent advances in a given branch or problem, for specialists in other fields, or people who are at least reasonably well-informed.

Given the circumstances, the new literary genre being invented remained more of a program than a real production. But this too is related, of course, to the character of its initiator and conceiver. The published book is more a presentation of the concept of disparity than the illustration of a fully realized variety of literature. It obeys a rule, which could be the opposite of Erving Goffman's axiom: "***A blender makes a mush of apples and oranges; a student shouldn't.***"

All the same, the project was a great success, which contributed in no small way to the reputation of Les Cahiers du Sud. Of course, the texts don't exactly cohere, each with the others, but the very mixture of the texts, which are stylistically and conceptually unequal, is also one of the book's great aesthetic strengths (which can be compared to the "Japanese" aesthetic of the unconcealed coexistence in a tapestry or collection of poems of its underlying structure and design).

Here, too, FLL raises a question that seems both insoluble and pointless in its apparent, anachronistic hopelessness: the question of beauty. Apart from the presentation of the book, divided into sections, The Great Currents also contains an article written by FLL himself and entitled "Beauty in Mathematics." The author of Les Prix de beauté aux échecs (Beauty Prizes at Chess) of course owed it to himself to attempt the same paradoxical effort with mathematics.

It soon becomes obvious (as is almost always the case with him) that the article in question was not really conceived, thought

through, argued, or written up, and that it is in fact a hasty juxtaposition of notes taken at widely different eras then thrown together any old way with, as a protective lid, a quotation taken from Henri Michaux's *In the Land of Magic* (it shouldn't be forgotten that FLL was a member of the magicians' guild): "It is what is most interesting in this land, because you can't see it."

It is a remarkably exasperating text, disappointing and at the same time fascinating. Reading it is like opening a herbarium made up of specimens of rather varied interest; there are quotations gleaned during the course of FLL's massive, heteroclite reading: striking thoughts from great philosopher-mathematicians such as Leibniz rub shoulders with utterly unoriginal scraps of introductions to old fast-lane math manuals, and aesthetic judgments going back to the President's high-school days: "The cycloid, that beautiful Helen of geometry . . . (!)"

But, sometimes, one of these chance encounters, which add nothing to our knowledge and have no historical importance, either in the history of mathematics or of literature, manages to pull its weight simply as a fragment in a collection of fragments, put together into this text by that author for oblique reasons, thanks to the multiple echoes it creates (even though they, too, are generally contingent and absolutely unconcerted).

In this context, I should like to mention an allusion to the sixteenth-century mathematician and poet Jacques Peletier du Mans, which François Le Lionnais discovered while reading Montaigne's *Essays* and makes mention of as an early reference to the idea of the asymptote, refracted through a sentence written by a non-mathematician, but with his inimitable charm: "*Jacques Pele-*

*tier told me, at my own house, that he had found out two lines stretching themselves one towards the other to meet, which nevertheless he affirmed, though extended to infinity, could never arrive to touch one another."*

(I mentioned FLL's "oblique" reasons. Here is just one (which will be taken up again in branch five of my work, if ever it sees the light of day and if it is what I say it will be): there is a certain family resemblance of spirit between Peletier du Mans and FLL's closest friend, Raymond Queneau.)

### **63 At such moments, you are not sorry to be reading it.**

At such moments, you are not sorry to be reading it. You forget, or neglect, your growing irritation at the imperfections, inexactitudes, and the regrets you feel about all the missed opportunities to shed light on powerful, striking ideas, which appear only episodically, and then almost shamefully; and so on.

But the reason for all this is not due to inability, or negligence (though both might be suspected). An image of the invisible, suppressed anarchism of the President-Founder of the Oulipo, as well as a genuinely aesthetic position, are trying to find a form of expression, which FLL's (quite apparent) lack of ease with his prose prevents from emerging fully.

Far deeper than the beauty of the banal belles in fashionable mathematical engravings of "dream girls" and "stars," such as the curves discovered by eighteenth-century analysis, for example the logarithmic spiral dear to Euler, or their "descendants," more difficult to imagine, such as elliptic curves (as shown in FLL's text)



(today replaced by “fractals” as the “super models” of mathematics), quite a different form of obscure beauty attracted FLL, and to describe it he adopted this elliptical, surprising, unexpected (for the layman) quotation, taken out of context from Hegel: ***Mathematical representation is a tortured representation.***

In his house in Boulogne-Billancourt, on Route de la Reine, François Le Lionnais spent his last years surrounded by his library, a prototype of the “great currents,” a sort of reservoir or monument of generalized versions of the Gr.C., covering various fields of knowledge, disparate, disordered, intertwining, labyrinthine mazes void of theory, long sequences on shelves in tortured yet necessary arrangements, potentially rich in sudden resonances or flashes from unexpected juxtapositions (alas, his library did not survive him).

It reflected his theater of memory, his dream of containing all the world’s knowledge as a macrocosm in the microcosm of just one head (armed with books as antennae), to complete his personal encyclopedic project, which might have been useful to other heads, any head, or all of them (the point was not to keep it all a secret).

Of course, such a project is impossible. It can never be carried out within the limitations of one body. It remains forever potential, virtual (which also explains why, as Rimbaud said, we cannot “possess the truth in one soul and one body”). Having no real gift for prescriptive injunction, I would not go so far as to say, as Jean-Claude Milner did (though I recognize the accuracy and inevitability of his diagnosis): ***“the professional intellectual must be an encyclopedia: he must know everything, the only limits come***

*from his body. A specialist who knows only what concerns his specialty, or a thinker who cannot reason, are ignoramus*”; but it is certain that the desire to know everything possessed François Le Lionnais.

Earlier, I said that his home, which housed along with his cat a library that was almost a living being itself, was his theater of memory. I should instead have called it a *boutique obscure*.

During a trip to London, Marie and I went into an almost invisible store on Drury Lane, kept by a Mr. Poole and called His Nibs. Sure enough, it sold nibs, all kinds of nibs for fountain pens, for all sorts of ink, from the commonest to the most peculiar, of all shapes and sizes, enclosed or lying open in boxes of every kind of format, with designs irresistibly evoking old-fashioned scripts, and Mr. Poole, an old white-haired man, jovial and kind, with rather a Pickwickian look, and red cheeks from frequenting the nearby pub, was the only person who could find his way around. (Nibs purchased that day were to travel as far as Beijing, to land on Anne Thiollier’s desk, for her illustrations.)

François Le Lionnais’s head, weighed down like a stag by its horns, by the peripheral organs that were the shelves of his library, was also a “dark boutique,” where, at the end of his life, he was the only person able to recognize himself; before recognizing himself not quite so well, then failing to recognize himself ever again.

## Chapter 3

### Neighborhood Filter

#### **64 To begin at the beginning, of course; but which beginning?**

To begin at the beginning, naturally, as I said on finishing chapter 2; but which beginning? I needed the illusion of an absolute beginning; I needed to believe in something more than simply starting all over: beginning once again my enterprise to understand mathematics. I needed to believe that I had never really begun, that my decision, taken over two years before, had not really had any subsequent effect, or else that I had so far done only preparatory work for it, a necessary but nonetheless secondary training program; and it was precisely the fact of having delayed my beginning for too long that more or less accounted for my relative lack of success.

I was gripped by the vertigo of beginning. My life, until that day (eight years ago, today) when I “[wrote] down on paper the first of these lines of prose” that are today continuing in those I have just caused to appear and to shuffle up against one another on my screen, was an unbroken succession of fictional beginnings. I wanted each of them to be singular, decisive, radical, to make everything that had preceded it in the same sort of activity negligible, unrealizable, or out of date. Almost everything in my existence was, thus, affected by these attempts at voluntary ruptures: my mealtimes as well as my intellectual explorations, the writing of books as well as the reading of newspapers.

The mathematical beginning that then appeared to me to be so imperiously necessary, and which would as a consequence never take place, should be absolutely pure so as to allow me to recover the enthusiasm required for entering into a vita nova (I thought I had entered into it on going through the doors of Lycée Jacques-Decour, but that had been a mere illusion). I thus ought to give up what I was doing (and doing increasingly badly) at once, stop studying for the certificate of Differential and Integral Calculus, and drop the idea of taking another “year” of Russian at the school of Oriental Languages; I ought even to stop writing poetry (I was, in any case, at a virtual dead end), so as to concentrate all of my energy on starting anew once and for all. There is no other way to describe that contradictory conviction, constantly reborn from the ruins of previous failures, which allowed me to see myself as beginning something only if I imagined that this beginning would in some sense be permanent, would remain new and brilliant day in day out and accompany me entirely in carrying out my task, which would have no end.

In the particular case of mathematics, this demon of beginnings had a face; Bourbaki. The introduction to each volume of the Treatise, entitled “Advice to the Reader” provided, in thirteen short paragraphs, just what I was looking for: *“This series of volumes . . . takes up mathematics at the beginning, and gives complete proofs. In principle, it requires no particular knowledge of mathematics on the reader’s part, but only a certain familiarity with mathematical reasoning and a certain capacity for abstract thought. Nevertheless, it is directed especially to those who have a good knowledge of at least the content of the first year or two of a university mathematics course . . .”*

I had these four pages by heart (→ branch one, § 135), and they are still almost as present in my mind as some poems from *Les Contemplations* or *La Légende des siècles*, certain sonnets by Shakespeare, Baudelaire, Nerval, Ronsard, Cros, or Mallarmé (they are all contemporaries in my memory). Before ever opening a single one of the volumes of **The Elements of Mathematics**, published in the series *Actualités scientifiques et industrielles* by Hermann & Cie, under the name N. Bourbaki (on the title pages, nothing indicated that the N. should be read N(icolas)), I had read and reread those pages so often, weighing up and delighting in each of their words, that I knew them as one does a poem, in other words without ever separating sense from letter, or taking the slightest analytical measure of their meaning.

I had no trouble convincing myself that the conditions for a perfect beginning were all present: mathematics was taken up “at the beginning” (according to what I had been told so decisively), and I more or less fulfilled the required conditions for reading the Treatise. As I took on board the indications in the *Advice to the Reader* without any critical spirit (it was essential for me to accept them on trust, on blind faith, if I was to keep up my initial enthusiasm), I had no doubts about the fact that “***the demands of proof (the main purpose of the treatise, which is to provide a solid foundation for the whole body of modern mathematics*** (the parentheses are mine—J.R.)) ***impose a rigorously fixed order on the subject matter.***” And I would follow this order. I would be the most faithful reader, the most obedient guinea pig.

I would start with the first part, devoted to the “Fundamental Structures of Analysis,” I would assimilate Book I, Theory

of Sets; after Book I, Book II, Algebra; then Book III, General Topology; and so on. Once armed with these (massive) preliminaries, I would dive into the mysterious “following parts,” in which *“the general principles studied in Part 1 will find their application in theories in which diverse structures intervene simultaneously.”*

I then encountered a particularly flagrant example of the paradox of beginnings. How to begin with the beginning of the Treatise, as the “advice” invited me to do, when Book I, in which the famous theory of sets was to be presented, had not been finished? Bourbaki had provisionally done away with the difficulties inherent to this paradox (which stuck to its fingers), which was especially bothersome for such a project: taking up “mathematics at the beginning” is all very well, but how to be sure that the real beginning has been reached, without first examining the “pre-beginning”? Here resided (though I missed it completely) a deeply serious question, associated with the solidity of the “foundations” that the authors claimed they were giving to the entirety of modern mathematics. This paradox of beginnings was compounded by what might be called the paradox of conviction, better known to logicians as Lewis Carroll’s paradox ( $\rightarrow$  § 75–77).

In the volumes published at the time, Book I was represented only by its “Summary of Results,” which contained various definitions and propositions without the slightest proof ( $\rightarrow$  § 78–80). I discovered that it contained some of those trivial but strange matters that Choquet had rapidly presented to us during his first lectures, here amplified, but still similar.



65 It was quite clearly impossible for me to begin in such a disappointing way,

It was quite clearly impossible for me to begin (when giving the word “begin” all of its strength as a decisive event, or origin) in such a disappointing, almost mediocre way. Firstly, the subject was not totally new to me. Even if I had listened to Choquet’s first lectures with an ear as outraged as most of my neighbors’ in the lecture hall, the words “set,” “element,” “intersection,” “product,” etc. were no longer unknown to me, and the symbols used to depict them were no more indecipherable for me than the Cyrillic alphabet.

More decisively still, my resolution to devote myself henceforth and for ever (as one might say, using a pleonasm of insistence, as in medieval prose) to studying Mathematics according to the Bourbakic conception—people usually say “Bourbakian,” but “Bourbakic” sounds quite good to me in this context—even before having any real idea of what it in fact was), accompanied by a fairly resolute rejection of all the other ways to approach this science, and in particular those I was supposed to take on board during my year of Differential and Integral Calculus (which featured not only Choquet’s “supposedly modern” lectures (as Lusson put it) but also the profoundly traditional (and at the same time highly confused) ones by old Bouligand).

This internally rigorous attitude would allow me to skip, without feeling too much shame, the end of year exam, which I would have been hard pressed to pass, given my work backlog. What’s more, I wouldn’t have enough time, because I would now devote

most of my powers to what had become essential (I was already “wasting” enough precious time with physics, Russian, and going to see movies at the Cinémathèque Française, which at the time was situated perilously close to the IHP on rue d’Ulm (and I did not see them alone); not forgetting the ardent “political meetings” during the immediate post-Stalin period).

To sum up, I had created a dichotomy for myself, which was not unlike the one that finally chased me away from studying literature, between a passionate and utterly gratuitous activity on the one hand (poetry) and the dull (obligatory to boot) routine of school or university lessons or exercises on the other. Even though I had moved from French literature to English at the Sorbonne, then from the Sorbonne to Oriental Languages, then suddenly from Letters to Science (while following more slowly, but just as inexorably, a parallel path in school slang from “hypotaupe” to “taupe” and then to the IHP), I was back in a very similar situation: “real” mathematics now played the role that poetry used to have. Facing it, all I could see was grayness. All I felt was a lack of curiosity, insurmountable weariness, almost disgust.

Yet, I had arrived at the material end of all possible vacillation. I couldn’t try my parents’ patience eternally (particularly financially), because they had three other children, younger than me, thus approaching a degree in mathematics as I had done the entry exams to the *grandes écoles* (though this did at least give me the dubious pleasure of sometimes introducing myself as “former future pupil of the Ecole Nationale Supérieure (*Section des Lettres*)” & “former future pupil of the Ecole Nationale Supérieure (*Section des Sciences*)”), and likewise my English degree and Russian di-

ploma, was out of the question. I was starting to get an extremely bad conscience.

So I made a compromise with myself (I have plenty of practice). It meant a sort of delayed future action. For about twenty months, i.e., until the new academic year, but not the next one, the one after next, I would devote myself almost entirely to studying Bourbaki.

I would use the knowledge I had thus acquired to acquire one or two credits toward two certificates, whose names (Algebra and Numbers Theory) or else the personality of their lecturer (Choquet for Topology and Function Theory) seemed to me to be close enough to doctrinal purity (verified indirectly by Pierre Lusson and Philippe Courrège) to be accessible to me. I would also take a few esoteric courses just out of interest. Then, and only then, would I swallow the bitter pill of the three certificates that were “indispensable” for a “teaching” qualification: “Differential Calculus” (the one I was now giving up and which would presumably not be such an obstacle for me later on), the terrible General Physics, and the no less terrifying Mechanics (likewise of the general sort, while they were about it).

And this is, more or less, what I ended up doing, though even more slowly than I had planned, and very poorly when it came to the results, which do not concern this tale.

So there I was, once again, at the end of the winter of 1954, still not having started the Treatise, apart from reading and rereading the Advice to the Reader, the Introductions to the various volumes that had been published, and the enticing “Historical Notes.” After the Book on the Theory of Sets came, in the “logical” order of

their presentation, Book II, on Algebra. However, it was with the first chapter, “Topological Structures,” of Book III, General Topology, that I really started my solitary initiation.

## 66 Introduction to “Deductive Landscapes.”

### Deductive Landscapes

#### Elements of a Science of Place (preface)

for Pierre Lusson

*In order to bring out what is essential in the ideas of horizon, reading, and visibility, we shall begin by analyzing the notion of visibility (although historically it appeared later than the other two). If we start from the physical concept of contemplation, it is natural to say that a region of a landscape is visible from a given region if, whenever we replace it by a detail contemplated from it, this new detail will also belong to the region in question, provided of course that the journey involved is small enough. This definition is meaningful whenever precision can be given to the concept of a sufficiently short journey or of a detail that is sufficiently legible from another.*

*In this direction, the first idea was to suppose that the “mutual memory” of two details can be measured by a (future) instant.*

*Once the “mutual memory” between any two details of a landscape has been defined, it is clear how the “visibility” of*

*a detail should be defined: a region containing any detail will be visible if it contains all the details whose memory of an initial detail is contained in some pre-assigned strictly future instant.*

*Of course, we cannot expect to develop an interesting theory from this definition unless we impose certain conditions on the “memory” (for example, those relating the mutual memories of subjects in love in an inner life should continue to hold in a generalized memory). We shall study such remembered landscapes in a subsequent chapter.*

*So far, we have not succeeded in freeing ourselves from time. Nevertheless, the landscapes so defined have a great many properties which can be stated without reference to the “memory” which gave rise to them. For example, every region which contains visible details of a given location is again a visibility of this location, and the intersection of trees in two visibilities form a visibility, etc.*

*We are thus led at last to the general concept of a legible or moralized landscape, which does not depend on any preliminary theory of time. We shall say that a landscape carries a reading (or a moral or else a scene) whenever we have associated with each place in the landscape, by some means or other, a family of regions called its visibilities—provided of course that these visibilities satisfy certain evidences.*

*The choice of evidences to be imposed has historically been the subject of a great deal of experiment. The system of evidences finally arrived at is broad enough for the present needs of poetry, without falling into excessive and pointless generality.*

*The branch of writing which studies the reading of landscapes bears the name of science of place (etymologically, “painting,” not a particularly expressive name), which is preferred nowadays to the earlier (and synonymous) name of dramaturgy.*

## 67 Keeping the general, solemn tone of the original

Keeping (of course) the general, solemn, precise tone of the original, this (admittedly bizarre) text composed using quite a simple Oulipian technique (the substitution of several semantically significant words in a source text while keeping the syntactical skeleton more or less intact), or theoretical prose poem (which I gave to Claude Royet-Journoud for the issue he was curating of the *Revue de l’université de Bruxelles*, *Travail de Poésie*, which was published in 1979) is an essay written using one of the ten “styles” of prose I am putting to the test in the series of books (which I call branches) of which this is the third (the overall title being “**The Great Fire of London**”), in this case double style.

The source text, the origin of the transformation that remains invisible “behind” the poem, is the “Introduction” to Bourbaki’s book of General Topology. (The invisibility of one of its components is one of the possible approaches to the double style.)

The intention of the poem (for it is a poem with an intention; a poem’s intention, when it has one, is not the meaning of the poem, but may be used to describe it) was, firstly, to transpose the presentation of the theory of sets into a theory of places. I would describe it as an announcement—but only in order to be able to state the poem’s intention, so to speak, as the “interpretation” that the po-



em's intention requires if the source text appears as one of the components of the double, with the poem itself being the second one—an announcement of the necessary conditions for constituting an idea of space in a “proem for a poetic theory of landscapes.”

As such, and according to this aspect of its intention, the transposition could be pursued. (The poem, when read this way, appears as the initial element, or presentation, of a sequence; which it is, but I published it on its own, and am commenting on it only in its isolated state.)

More “detached” from the nature of its transposition, the poem's intention had a second aspect, or “meta-aspect” if you will, which was to take the book of General Topology, and from it its first chapter (the first one that I read), and from the beginning of this first chapter the general introduction to the book (which the poem thus translates), as an image of the entire project of the Treatise in its unfinished state, which was unforeseeable for me at the time when I started reading it, but which was judged, once again by me, to be inevitable by the time that the writing of this poem had been decided upon.

The “meta-aspect” of the poem's intention was, then, one way to say farewell to Bourbaki, though it is not a leave-taking (in the troubadour's sense of the term: a rejection) (I had already imagined and composed one of these in 1968), but more “positively” it identified the indelible “mark” of their influence, after all those years spent in their company, on the idea I had formed of poetry. And of prose, too (→ branch one, chap. 5).

It was a “topological” Idea (which I shall here leave broad and vague) to which I was also saying farewell at the time, or at least

to its most ambitious variant (in which Bourbaki, or the Bourbaki of Topology, actually played quite a limited role), which was the one I had recognized as being necessary to my **Project** and to the novel that was meant to accompany it (I had just given up on both of them (→ branch one, preface, and perhaps a subsequent chapter in the story section of this branch); the mark that Bourbaki had made on the conception I had formed of the novel's prose was present in a different, more "local" aspect).

All of this to explain, after the fact, almost forty years on, why I chose Book III rather than Book II, Topology, or instead of Algebra. I allow myself this flagrant anachronism all the more easily because I have absolutely no recollection whatsoever of the reasons that led me to make that choice at the time.

However (probably because this is a posterior explanation), I can't imagine how I could have decided any differently, without there having been negative effects on what was to follow; for sets and Bourbakic algebra were not as distant from my mathematical experience at the time as topology was. I had chosen a way that was, for me, a genuine beginning.

## **68 The moment of this narrative encounters the moment of this narrative**

The moment of this narrative (in its primary sense: the moment at which this narrative is being written, the first half of August, 1993) encounters the moment of this narrative (understood in a secondary sense: the moment that this narrative is narrating right now) like a photographic image.

If it is true, as I am supposing here, that a photograph is “the meeting between Uncle Emile and the Eiffel Tower” (→ *Alix’s Journal*, Appendix I) and that it is (leaving aside for the moment any question of beauty, which would needlessly complicate the situation) just like “the chance meeting of an umbrella and a sewing machine upon a dissecting table” (“the photograph” being in fact “not the dissecting table but the meeting”);

if it is also true that “every memory is the memory of a moment; any image is the image of an event,” that the event qualified by the photographic image is “the co-presence of Uncle and Emile and the Eiffel Tower,” and consequently “certifies the reality of a moment in the past, which has, thanks to the photograph, become an event,”

if all of this is admitted, the moment I started reading the first chapter of Bourbaki’s *General Topology* (in early 1955) (the moment that I am narrating) is like (this “like” being a meeting, in the sense of the word used above, in the second and third paragraphs of the present prose moment) the present moment of my existence, or the moment when I am narrating. I can “see myself,” “sense myself,” “picture myself” in one of them, the present, just as I can “see myself,” “sense myself,” “picture myself” (respectively) in my memory, and also remember that I could at the time “see myself,” “sense myself,” “picture myself” (respectively, too) in that other, that moment from the past which I am exhibiting by dint of a serious effort of memory.

This mirroring, comparison, or identification of inner states is contingent. The memory-image, like a photographic image, can show the coincidence between all Uncles Emile and all the Eiffel

Towers only as a contingent meeting, from which any prior necessity has been excluded.

In fact, if I were to try to establish a relationship of causality between the two moments I'm discussing, by focusing on whatever points seem to establish their family resemblance, I would be incapable of choosing in which direction this relationship should run. For I could equally well imagine that the past moment arose as a present image because of the circumstances of the moment at which it was recalled or, on the contrary, that it is the very nature of this moment—as well as of those that precede and follow it in my story, and thus of an entire network of past moments which have been assembled under the common “theme” of my beginnings in mathematics—that has determined the circumstances in which I now find myself and made a feeling of identification natural.

I shall begin by describing the first of these two moments, that of the present (a necessary precedence, because the description of the second one will derive a great deal of its “tonality” from it, and the contrary is scarcely possible without imagining some hidden genealogy, which is in any case inaccessible).

For the past three weeks, since my return from the damp and misty Orkneys, I have been gripped by a fit of one of my fundamental passions (→ branch one, chap. 4): the passion for solitude. The month of August, of course, aids this passion: the building where I live is almost empty, the streets deserted; the telephone, which I never answer, barely rings; no obligations, or nearly.

But I have isolated myself even more than it would be natural to do (an isolation within an isolation): I spend whole days without

going out, in this space, cramped and dark, voluntarily dark, and voluntarily even darker than is usual for me, in this space that is mine, devoting my time almost entirely to the progression of these pages, which thus far had occupied me (at least during the writing of the first two, completed branches) only during the early hours of the morning. And yet—or perhaps: of course—it is precisely at this very moment that I feel most like a prose snail, and cannot really say to myself, like Alceste to Oronte: “time has nothing to do with it,” because part of my intention, which is far from secondary, in writing memory prose extremely slowly so as to tame into sentences the sudden handfuls of recollections that my meditation, no matter how strictly concentrated, almost obtuse, directed along one single “line,” drags up in my head full of shadows, means that I can grasp only a small part of them. But I press on.

#### **69 A September rain rains on the courtyard of the Sorbonne.**

A September rain rains on the courtyard of the Sorbonne. It is raining on the dusty windows of the dusty reserve stacks of the university library. I go through the special entrance that provides access to this treasure trove of books, which can be borrowed by the members of the teaching staff in the *Grands Établissements*, those public institutions still situated on the territory of the ancient and now scattered “University of Paris,” whose name now refers to all of the university colleges in the city and its suburbs.

This right is an old one, now threatened by universal modernization. One of its clauses is particularly dear to me: I can go myself to fetch the books that interest me from the shelves and take

them home (unless they aren't for loan). I will lose this right when I retire. And I will lose it even sooner if the administration of the Sorbonne library succeeds in suppressing it, and in chasing me from this refuge, this garden. I will not lose (in the latter case) the right to borrow books, only that of fetching them myself, removing them from their dust, then taking them downstairs to have my loans recorded (and these are far more limited now as far as duration and number (of volumes) than in the past).

But, you might say, would it not be better and more comfortable (especially at your age) to make a request at the front desk then patiently wait for the book to appear, without having to go up and down the stairs (and then up again from the basement), bending awkwardly toward the lower shelves while attempting to decipher the reference numbers in the poor light, albeit in the extraordinary, heady fragrance of the old dust of old paper or old books? Of course. But the pleasure of the path leading to a book is intense. It creates the illusion that the library is yours, because in your own collection (in mine) this is how you would fetch a book; no one brings it to your table, thus depriving you of this personal, physical relationship with it. And in this large library, which has momentarily become mine (in which at certain times of the day I encounter practically no one, except a librarian on one of the staircases, loaded down with a huge pile of books requested in the students' reading room) there can be found (unlike in my own collection (or nearly)) books that are unknown to me.

But, perhaps my greatest attachment to this so clearly "obsolete" (according to the prevailing managerial rationales in our latitudes) way of doing things derives from a variant of what Aby



Warburg called the law of the good neighbor. To sum up his argument, a library is only a library worthy of that name if it satisfies the following condition: when you go to remove a book from its shelves, the one you really want is the one next to it. The library of the Sorbonne may not be a library in the Warburg sense of the term, but it is both huge enough and small enough not to rule out unforeseen discoveries, if time is taken to “look around” the book you have come to collect.

I never fail to exercise this unorthodox version of Warburg’s law, adapted to the conditions of this particular library, in which coincidences are not entirely random but determined by chronology, the divisions between fields of knowledge, as well as the preferences and expertise of the library book buyers.

This is why I always look around the place where the book corresponding to the classification number I jotted down in my notebook is found (or should be found, if it’s missing, having been borrowed by another user, or lost). I have often left again with titles other than those that had led me down to the third “Turgot” basement or seventh floor of Storeroom B, because their unfamiliar printed faces seemed far more attractive, and even essential.

This will be the twenty-fourth autumn that I have benefited from this wealth. I first entered the reserve stacks in 1970, when I became a professor at the University Paris-X, Nanterre. Fifteen years before, I had come here to read Bourbaki.

As a student, I was obliged (like today’s students) to ask for books at the two “windows,” A and B; and it was a revelation for me, an overdue answer to an old question, to discover when I went through the door leading to the shelves the reasons for this

strange dichotomy in the architecture, which split the library into two “stores,” A and B, connected by a walkway on the second floor (when going from one to the other, from A to B, you went through a room mainly inhabited by Russian books (→ § 83), disturbing some Slavic scholar or other with bushy eyebrows, who would raise his head for an instant from some heavy, gray quarto printed in pre-1917 Cyrillic characters, looking at you with ill-willed irritation, ready to utter an inner curse filled with numerous “spirit letters,” called “rough breathings”).

(A circular corridor, at the far end of the third floor, colonized by Anglo-American literature, provided a second means of access to store B. It was there, on stopping for a moment at the entrance to the corridor, that I discovered a “concordance” to Shakespeare’s works (one of those fascinating, dizzying undertakings that cover all of the occurrences of all of the words in an *œuvre*), which kept me standing there for some time. I was not surprised to learn that “and” and “the” were among the words used most frequently by the Bard of Avon (all of the instances were listed, as is the rule with concordances). When studying English iambic meter, I took out these weighty volumes—meticulously, ponderously, and Germanically compiled—only to discover to my annoyance that the indications of context, which provide all the charm of such studies, had been calculated according to a statistical formula of extreme effectiveness, explained carefully and justified linguistically at great length in the preface, while taking no account of a certain unity in the great majority of Shakespeare’s statements, i.e., that they originate in lines of verse. If the word in question happened to fall in the middle of a line, then there was an average chance

that the line would be reproduced in full in the concordance, but this was very often not the case, and so it was still necessary to consult the primary text, even though this tool was supposed to make it redundant!)

**70 When I convoke the inner memory-image of the reading room in the library of the Sorbonne,**

When I convoke the inner memory-image of the reading room in the library of the Sorbonne, which I occupied in the evening, or some evenings, from the early months of 1955 until December 1959 (and it often arises of its own accord, at night, without warning), I am gripped by nostalgia. Here, for the first time, the enchanting world of libraries, both public and specialized, opened up for me, and it has never closed again since. There is a headiness about reading in libraries that is different from reading in your room, at your desk, on the train, or in the park—which are no less enchanting, but different (and I do not mix what I read; I do not read the same things in different sorts of places) (→ § 84).

The memory of those times is associated with the hours of evening during the three seasons of student life (not the summer), and thus with night, already fallen or falling. At the time, the reading room was open until ten o'clock (the great poverty of university libraries means that this is no longer the case today) and, while it was difficult to find a place there at the end of the afternoon, a great studious calm generally gripped it later in the evening, when the majority of its readers had gone to the cinema, or back to their families, to their tiny rooms or halls of residence.

I went there secretly, or at least clandestinely (I told no one about my visits). I bumped into nobody I knew. Math students didn't frequent this place, so inhospitable for them, situated as it was at the very heart of the literary Sorbonne, up the entrance staircase (the reading room was on the second floor), flanked by the Richelieu lecture hall on one side, and the Louis-Liard room—site of countless thesis *vivas*—on the other, and which was to top it all off rather a long way away from the Institut Henri-Poincaré. Instead, they went like sheep to Sainte-Geneviève library (having little choice, except for the Normaliens and a handful of other privileged users who were allowed access to the IHP's own book collection). And I didn't want to be seen reading what I was reading: Bourbaki's book on General Topology.

The feeling of strangeness and joy that this memory gives me also derives from the fact that those early hours of evening are not at all the usual time for my intellectual endeavors. I go to bed early and think or write (generally while it's still dark) only during the early hours of the morning. As the time that I spent there in the library required some of the most intense efforts I've ever made, and as that continuous flow of effort meant that I succeeded (for once) in forcing myself to reach the objective I had set, I have often dreamed of doing something similar again; in vain; hence my bitter regrets, and the nostalgia.

A secret place was essential. I could not conceal the fact (least of all from myself) that reading Bourbaki wasn't exactly what I should have been doing in order to pass the exams that I was supposed to be studying for, and particularly not for General Physics, whose fatal trinity of electricity, optics, and acoustics filled me

with relentless boredom every time I tried to approach it. I was living with my parents, on rue Jean-Menans, a small street near the Buttes-Chaumont in the nineteenth *arrondissement*. My room was small, cramped and not a suitable place for isolation. Furthermore, I would not have been able to work on Topology in my room without buying the Treatise's several volumes (which were quite expensive; only later did I come across a few second-hand copies at Gibert, of all places!). But the main reason I couldn't work there was that I would have had a guilty conscience. My conscience was just as bad at the Sorbonne, but at least there my shame could remain hidden from everyone else.

I had added a layer to my camouflage by claiming that the late hours I was keeping (sometimes for other more or less secret reasons, of a sentimental nature) were due to my political activities, meetings in cafés about the burning topics of the day, for example the rearmament of Germany. But Stalin's death and what had started to seep out from under the cover of that particular cauldron had chilled my militant fire (which had never raged all that much). Reading Bourbaki had become far more important, but this didn't prevent me from feeling some remorse about this, thus making it all the more imperative for me to have a secret place where I could indulge in an activity that was almost unjustifiable in my own eyes.

I was one of the last to leave the library. Ten o'clock was chiming in the courtyard of the Sorbonne, and the Sorbonne bell was chiming as it had five centuries before ("I heard the bell of the Sorbonne," says an octosyllable from Villon's *Testament*; so did I, but it did not incite me to pray; assuming that Villon in fact prayed

in anything other than verse). I crossed the courtyard, went down the street of the same name, and then Boulevard Saint-Michel, after a short stretch of rue du Sommerard (a name foretelling insomnia?), as far as the metro. On changing at the Gare de l'Est, I had to wait for a long time for the connecting service toward Pré-Saint-Gervais, a "half-line" at the time shared with the one that went to Porte de la Villette, which followed the same route as far as Louis-Blanc (which gave me a chance to correct my course if I'd gotten onto the wrong train (as I sometimes did)). (It has since surrendered the dignity of being a "half-line" to its rival, and is now just line 7b. Fortunately, its downfall only occurred long after my departure from the nineteenth *arrondissement*. How could I have stood it?). Finally I alighted at the Bolivar station, went up Avenue Secrétan, etc.

Almost every evening, on the opposite platform, right there in front of me, during the academic months of at least two consecutive years, a rather beautiful, if slightly chubby, young woman with the most extraordinary big violet eyes stood waiting for her metro—they were a deep, velvety, unimaginable color, at once ultraviolet and situated in the visible spectrum, or nearly. Evening after evening, on the two parallel, almost deserted platforms, we waited patiently, I for my metro, she for hers.

Despite all my efforts of unspoken persuasion, despite the intensity of my desire to plunge into the immensity in the violet depths of her marvelous eyes, I never succeeded in meeting her gaze, as she always ignored me, always, whether still or in motion, during those long waits for the rattling of our infrequent, nocturnal trains, she conscientiously scrutinized every inch of the Gare



de l'Est, the seats with their scattering of travelers, the damp rails, the dark openings of tunnels, and the walls covered with advertising posters, everywhere that I was not, without ever once, even for an instant, deigning to illuminate me with even one of her violet rays, the alpha and omega of my desire, which she dispensed so generously to all the world's indifferent objects (→ § 85). I remained infinitely absent from her field of vision, perfectly delineated in space by the property of being "the (sadly) open sub-space, complementary to the adherence of the set of points" where she did not look. Then she changed her schedule and vanished. But, in the meantime, I had understood the Book of Topology.

### **71 I sat down in the reading room beside the windows**

I sat down in the reading room beside the windows, as far as possible toward the right of the entrance (I could show you the exact place; I sometimes look it at when passing by, on my way to where the professors take their books out). When I arrived quite early, not having gone home for dinner with my parents but instead gulping down something ghastly (really ghastly, what I'm telling you is absolutely true) in one of the nearest of the so-called university restaurants (or "Resto-U," the nearest of which was on rue de Médicis), I sometimes had to stand and wait for a place to become free, and then, out of comfortable force of habit, for the one I wanted to become free in turn.

The first thing that strikes me today on opening a copy of this work on Topology (identical (save for the marks that were in that initial copy due to its belonging to the library, and then its bind-

ing and call number) to the one I read, which was the second edition), is that the greatest distance that separated it, over and above its contents, from all the other books that I had ever held in my hands at that time, was typographical in nature.

In order to reach the first words of the actual text, it was necessary to descend a ladder of titles, subtitles, and sub-subtitles, ranked by decreasing font sizes and indentations, but also marked out by parametric distinctions using *italics* and Roman, **bold** and light, SMALL and LARGE capitals, without forgetting numerical indications in Roman or Arabic numerals marking subdivisions, being set back or forward on the line, punctuation, different alphabets (Greek, Latin, Gothic . . .), etc.

From the imposing main title:

## GENERAL TOPOLOGY

you moved on to:

### CHAPTER 1 TOPOLOGICAL STRUCTURES

then to:

#### § 1 Open sets; neighborhoods; closed sets

and to:

##### 1. *Open sets*

(I am simplifying greatly), to arrive at last after this downhill slalom for the eyes at:

DEFINITION 1, after which came the first words of the actual text.

The choices of such distinctions had been thought over long and hard so as to obtain every bit of “necessary precision” in the Treatise’s educational objectives, which were never to be forgotten. But it is also true that a certain aestheticism came into play, which could be discerned in the background, and which irresistibly brings to mind the diligence of excellent primary school children (in the old days, in the era of the leaving certificate) or their teachers (old school too—I think of all those exercise books with their models for learning to read and write that my grandfather prepared for us (his grandchildren)). When I finally succeeded in mastering the contents of these volumes, I also had to agree that they were of intense beauty (a late resurgence of this admiration led me to greet with delight the resources of my “word processor,” which offers me a seductive profusion of ornaments that I find (“unfortunately,” says Marie, and some of my friends agree with her ) irresistible).

After DEFINITION 1, I read, with reverence:

*A topological structure (or, more briefly, a topology) on a set  $X$  is a structure given by a set  $\Omega$  of subsets of  $X$ , having the following properties (called axioms of topological structures):*

*(O<sub>I</sub>) Every union of sets of  $\Omega$  is a set of  $\Omega$ .*

*(O<sub>II</sub>) Every finite intersection of sets of  $\Omega$  is a set of  $\Omega$ .*

*The sets of  $\Omega$  are called open sets of the topological structure defined by  $\Omega$  on  $X$ .*

**DEFINITION 2.** *A topological space is a set endowed with a topological structure.*

**The elements of a topological space are often called *points*.**

Then you turn the page.

I read and reread these definitions countless times, the first page, and the following pages, without understanding anything, literally without understanding anything ( $\rightarrow$  § 87). But I only very gradually realized that the essential difficulty of the Treatise did not come from the extraordinary impenetrability of the subject (this is certainly not the case), nor a congenital incapacity of mine to understand (fortunately), but that I did not know how to read it.

Let me explain: I had never read a mathematics book of any sort. The teaching in preparatory classes was oral, as were the few lectures I had attended at the IHP. And neither of the two types of reading that I was used to, novels and poetry, could help me to penetrate written topology.

My way of reading novels, the extreme speed with which I had always devoured them since childhood, would quite clearly be of no use to me in my new circumstances. Going quickly over a dozen pages, I discerned absolutely no narrative thread. If the Bourbakian topology discourse was a narrative (and it was, in a sense) then this narrative was quite unlike any that I had hitherto encountered.

Then there was poetry. Now, I read poetry not with a thoughtful slowness (which would have been useful here, had this practice been known to me), but very quickly (as with novels). However (as opposed to what occurred with prose), I would reread a poem over

and over again (if I thought the poem worth it) until I had repositioned all of its elements in the present, in the simultaneity of inward time (with some slight (regrettable) fragmentations if the poem was long). (I read a lot of poetry; I still read poetry in the same way.) So, without thinking, I started to read the paragraphs of Chapter 1 of the Book of Topology as if it were a sequence of poems.

**72 It took me a long time, a very long time, before I admitted to myself that my reading would not progress**

It took me a long time, a very long time, before I felt and then admitted to myself that my reading would not progress by just proceeding slowly, and refusing the curiosity of anticipation and the laziness of skating over areas that remained obscure. Despite everything, however, something about the way I read poetry remained attached to this endeavor; in the end, I knew the book, word by word, almost by heart.

I copied it out, page after page into a notebook that I took home with me on the metro, then I recited it to myself, page after page, in my bedroom, in the street, on the benches of the Luxembourg Gardens, as if the text was Shakespeare's *Julius Caesar*, Milton's *Paradise Lost*, Lord Byron's *Childe Harold*, or Pope's *Rape of the Lock*, which I had studied (in this same way, by learning them by heart) for the literature credit in my English degree.

It was with great caution that I tried to go back through the chains of reasoning in another way, to sum them up, paraphrase them, accept the idea that mathematics could be paraphrased (and is the thing that can perhaps be paraphrased most easily,

even with certainty), and as such was situated at the greatest possible distance from poetry (→ § 88).

Much later, I dared to confront the indispensable exercises. The Advice to the Reader had warned me that I could not do without them: “*The exercises are designed . . . to enable the reader to satisfy himself that he has digested the text . . . [they] may be omitted during the first reading . . . but the student is advised to solve them at the latest during his second reading. The most difficult ones are marked with sign ¶*” (like the “flag” on beaches forbidding bathing). I waited even longer before attempting a “flagged” exercise. It seemed easy. I then realized that my solution was wrong. I tried again. In one or two cases, trembling slightly, I asked Choquet for advice (one of their presentations was incorrect; I felt scandalized). But I finally made it to the end.

Subsequently, I was to encounter no more insurmountable problems when reading a volume of the Treatise, including the exercises (→ § 89). I concluded (rather hastily and very presumptuously) that nothing in mathematics was (for me) intrinsically incomprehensible. I could understand everything. The word “could” in the context of a narrative telling of past events is ambiguous. It might designate a future tense, or it might be the conditional. During those years when I was delighted with my progress, I didn’t really take stock either of the immensity of mathematics as it actually existed, nor of the speed at which it evolves, both quantitatively (the accumulation of new results) and above all qualitatively (the changing of viewpoints on this or that subject . . .).

Furthermore, my comprehension was merely the assimilation of a presentation, which may not have been perfect but was at least



extraordinarily well thought-out and organized, of a few sectors (at what was in the end quite an elementary level) of the mathematics of sets as seen from a particular perspective (Bourbaki's).

But all in good time: the abrupt realization of this state of affairs, which led to a real crisis in my relationship with mathematics, remains, at this stage in my narrative, in the unforeseeable future. What's more, it concerns only tangentially what I mean to begin (and only begin) to talk about here, which is not strictly mathematics itself, nor the details of my biography as a mathematician, but the contribution of a certain vision of mathematics to a **Project**, a project for poetry and a novel.

It is obvious that Bourbaki, or my intensive reading of Bourbaki, was a precondition for the very conception of my **Project**, even if, as we shall see (?), the model it took its inspiration from could be seen as being anti-Bourbakist (just as, so to speak, the conception of poetry that occurred naturally to me was anti-Surrealist). But the indirect influence of Bourbaki, deflected from its actual purpose, worked on me in several other ways as well. Here and now, I shall speak only about its role in my thinking about a distinction that is still relevant for me (and perhaps even increasingly so): that between prose and poetry.

It was due to an intrinsically contingent event—the fact of my starting with General Topology, which led to a second event, that it was this book, read with a decreasing sense of illumination from one chapter to the next, thus giving to the former event disproportionate importance as far as its mathematical richness and depth—that I acquired the key to understanding (with all of the very real restrictions I have just described), so that this event

now seems to me to be responsible not only for a large part of my vision of the **Project** and of the novel that was to go with it, **The Great Fire of London**, but also and more explicitly in this case of what I subsequently was to write upon their ruins, “**The great fire of London**” (in quotation marks), such as it exists as a sort of Treatise of Memory.

### 73 The title I have given to this chapter, Neighborhood Filter,

The title I have given to this chapter, Neighborhood Filter, designates and sums up an entire family of memories associated with the first movement of the Bourbakist tale as told in the book of Topology. Of course, it is not the most important part of the Treatise in terms of its mathematical results; it is just a beginning, it simply introduces some very general, albeit fundamental, concepts. It is necessary to arrive at the tenth and last chapter to be able to read about some rather more significant developments. All of this may be true, but it is not this aspect of the book that interests me here.

The notion of **filter**, as the historical note to the chapter indicates emphatically, provides this presentation with its truly Bourbakist stamp: “*General topology as it is understood today began with Hausdorff (in 1914),” I read, “who again took up the concept of neighborhood . . . and chose from Hilbert’s axioms for neighborhoods in the plane those which gave his theory all the precision and generality desired . . . the chapter where he develops [their] consequences . . . has remained a model of axiomatic theory, abstract but adapted in advance to applications . . .*

(Here, Bourbaki is not in fact just talking about Hausdorff but its own presentation, of which it is extremely proud (and rightly so, I think).) *Finally, the introduction of filters by H. Cartan . . . [thanks to] the theorem on ultrafilters, has clarified and simplified the theory."*

It is here that the word **filter**, and the image it at once evokes, places itself between topology as it actually is (if this can be stated with any real certitude; but for the needs of my narrative, right now, I can quite safely make such a hypothesis and state, to paraphrase Bishop Butler: "topology is what it is and not another thing"), between topology, then, and the persistent memory I have of it.

This means that it was impossible then, and is still impossible today, for me not to see these filters as being especially connected with, and even superimposed over, a mental representation of those exasperating filters for coffee makers. These were the objects that imposed themselves most imperiously on my sensorial apparatus, because of my clumsiness, which is especially obvious when handling such articles.

In particular, I think about the general sluggishness of the percolation of their contents, that brownish soup shamelessly called coffee, which always caused me to pick them up, despite all of my previous experience, before the liquid had completed its downward journey, and so scald my fingers; then burn my tongue by trying to dispose of this excess by drinking it too quickly. I can picture them, and I can at once see something like an icon of topological space, a kind of broad grassland of "points," each positioned above a filter-cup ( $\rightarrow$  § 90), its "neighborhood filter" (in the Bourbakist terminology), which receives its nature drop by drop

(such a drop being for example a point in an adjacent or totally disjointed space; being “separated” from its neighbors according to one of the ranked modalities of the so-called “separation” axioms; etc.).

The image then becomes amplified, multiplies, draws farther and farther away from the actual terraces of actual cafés to create something like a scaffolding, the magical superimposition of an indeterminate (perhaps infinite) quantity of filters, connected two by two, and letting through with increasing difficulty an increasingly pure quintessence of coffee.

The most perfect of these singular beings were those that “converged toward a limit” ( $\rightarrow$  § 91), which “tended” (blessed by topological vocabulary with something like a singular willpower, an inner force, or “impetus”) toward a limit point imaginable (imagined by me) as a sort of liquid, infinitely concentrated, a coffee bean in the saucer of space.

This image provided me with a representation of the idea of a point, which differed sharply from that of academic, elementary geometry, and for me it has completely replaced this latter.

And I shan’t even mention those divine and most singular ultrafilters.

#### **74 The image of the geometric point had changed in the inner space of my memory-imagination**

The image of the geometric point had changed in the inner space of my memory-imagination; the image of any point, or more exactly of the surroundings of a point (the “point” itself being, al-

ways, unimaginable, and its own image “approached” only as the trace left by the initial placing of the tip of a pencil, sharpened very finely by an almost perfect pencil sharpener, onto a sheet of paper that was itself almost perfect too), had been critically transformed; and this was true not only for a point on a line, a plane, in ordinary space, or even those spaces that are less easy for oneself to picture consciously (the inner space of our memories has a topology quite different from “Euclidean” space), such as Minkowskian space-time or the mythical spaces with  $n$  or even infinite dimensions (functional spaces, Hilbert spaces . . .); but this was also the case, and perhaps even more so, for the idea of a point in time, which is an instant.

But, the classical mathematics I was used to, as well as its physical and mechanical applications, of which I was not completely ignorant (differential equations, for example, and their relationships with the motions of bodies, celestial or otherwise), allotted an important, privileged place to a vision of time that was strictly and totally assimilated (after Newton and without being modified by relativity, at least for the elementary, ordinary parts of the sublunary world) to a set of points, or instants, distributed along a huge, infinite (eternal) line (limited by compactification at one or two points at infinity, depending on the case, thus locating the closure of the universe), which possesses a topological structure

(the Bourbakist presentation of which established this construction for me (and later, other “equivalent” ones) as a “continuum,” indifferently identified as a body of numbers, the “real numbers,” and as a straight line on which piled up a superabundantly infinite quantity of points (which it was impossible even to envisage “enu-

merating,” but which it was possible simply to envisage placing one after the other in a given “right order,” albeit without being able to say what the order was)). All of this was beautiful, strange, and dazzling; it dazzled me; yet it did not satisfy me ( $\rightarrow$  § 92).

For, in this case, the neighborhood filters that it was necessary to consider around a point were infinitely thin and flat, because this was all happening “on a line”; and I never could connect them, without serious effort, to my initial image (anchored in me prior to the discovery of their nature in the case of “real” time, because the hierarchical presentation in the book meant that more general topologies, poorer in structure, but far vaster, more varied, and considerably stranger, had been introduced to me first (exactly the opposite of the path taken by Choquet, who started with spaces with distances, metric spaces, and so-called real space, whose Kafkaesque name is  $\mathbf{R}$ )).

Furthermore, the separation axioms for the points on this time line, and in spaces with  $n$  dimensions containing distances (even in beautiful ultrametric spaces where, as in certain divine topologies, “the circumference is everywhere and the center (since it is potentially everywhere too) is nowhere”), isolated the points from one another in my vision in a way that was far too decisive and draconian for my imaginings.

I had a liking for a weaker form of separation, known as accessible spaces, satisfying Fréchet’s axiom:

**For each pair of distinct points, there is a neighborhood of one point of the pair that does not contain the other.**

The charm of this axiom came from the possibility in such a space that, for some of its pairs of points, each of the neighbor-



hoods of one of the points in such pairs necessarily encounters one of the neighborhoods of the other, and they are thus tangled together by the topology of their space, or world. This is, I think, what happens in the memory, when one tries with difficulty to separate different recollections ( $\rightarrow$  § 93).

(The axiom called (by Bourbaki) Fréchet's was also particularly dear to me, because when on vacation in a place that was both delightful and inexpensive at the time, called "La Messuguière," near Grasse, I made the acquaintance of its inventor, a pioneer in topology, who was then an extremely courteous and pleasant old man, all of which gave this axiom a great sentimental value in my eyes.)

The very poverty of the initial constraints regulating topological spaces clearly had to be abandoned rapidly when it came to approaching the real mathematical richness of objects (real numbers, complex numbers, etc.), but it was also an essential precondition for being able to represent inner time and space, that time and space which are in us, in and proceeding from our memories; and they should be represented as being very different from the usual image of them that we have (a difference I now consider to be real). Our conscious representation is just an external image that has been imposed on us since childhood, then reinforced by language and learning (and doubtlessly in itself quite unlike any form of reality).

Sitting in my place in the library (right in the back of the hall, to the far left of the last row, with the window to my left and the wall in front of me), the Book of Topology open, I filled the dark air of the Sorbonne's courtyard that pressed against the windows with

a topological fantasia. Out of all those evenings, my recollections have compiled only a single moment, which my memory wanted to be faultless.

It was there that, prudently, obstinately, poorly, slowly, I started to understand mathematics. It was there that, without realizing it, I started something other than the simple linear labor of comprehension: because comprehension, if it is not superficial, requires that confrontation with the mathematical unknown called “research.” I kept at it for years, no less slowly, poorly, obstinately, and prudently. And it was from there that later, imprudently, poorly, slowly, but no less obstinately, I imagined that I could make the little mathematical understanding I had acquired serve another purpose, which slowly, prudently, obstinately, I started to use, in various ways, in the diverse, oblique, uncertain, hesitant light of my memory.

## Interpolations in Chapter 3

### 75 (§ 64) **the paradox of conviction, better known to logicians as Lewis Carroll's paradox**

Lewis Carroll presented his paradox as a dialogue: “What the Tortoise said to Achilles.” Here, I have transformed it into a three-act play, in which the subject of the discussion is naturally the protagonists themselves (which Lewis Carroll did not do (and it’s a pity, I think), instead having them talk about what the Tortoise calls “that beautiful First Proposition of Euclid” (which is about triangles)).

### **How the Tortoise Fought Achilles**

Dramatis Personae: Mr. Goodman; Achilles; the Tortoise; Ottoline, the waitress in the tea rooms; the Hare; two referees—Carnot One and Carnot Two, ducks; two time-keeperesses—Shareek One and Shareek Two, seagulls.

#### Scene 0, or prologue

#### Mr. Goodman:

That day, I had gone to Cambridge to listen to a lecture by the famous philosopher, W, and had gone for a stroll along the banks of the Cam. It was in the month of May, and a delightful, polyphonic day. A flock of future Nobel-prize winners had descended on the river and were punting nonchalantly in the company of de-

lightful lady (or gentleman) undergraduates. It brought back my youth and I sat down, full of nostalgia, on the lawns of the College that had invited me. The sun was so tenderly sunny, the grass so softly grassy, and the ducks, as gentlemanly as ever, gathered so discreetly around me that I fell asleep. While dozing, I seemed to hear voices in my ear, and opened my eyes, or at least so it appeared to me as I slept, and saw Achilles and the Tortoise.

Achilles had put on his armor and was wearing his College colors; as for the Tortoise, it was quite modestly clad as a tortoise.

### Act I

#### Achilles:

What point is there, dear friend, in risking the dishonor of a humiliating defeat? You know perfectly well that I run faster than you. Don't you think it would be more reasonable to drop this absurd challenge? You know that I'll have no difficulty in catching up with you in this race. Let's rather go and have a nice cup of tea with scones and blueberry jam, topped with Cornish clotted cream.

#### The Tortoise:

With pleasure. Except that scones and clotted cream haven't been invented yet. We'll have to wait for over a thousand years. Let's sit down at this table.

#### Achilles:

Tea for two.

#### Ottoline (the waitress):

And two for tea; that's the life for Bertie and me.

#### Achilles:

And scones.

#### Ottoline:

With blueberry jam and Cornish clotted cream, I suppose?

Achilles:

Yes please.

Ottoline:

*Vous arrivez du Continent?*

Achilles:

We're from Greece.

The Tortoise:

Ancient Greece, if you don't mind.

Ottoline:

In that case, do you happen to be philosophers? Bertrand (he's my lover, by the way) says that the classical Greeks invented philosophy on the banks of the Aegean Sea. What's more, Madam does have a philosophical look about her.

The Tortoise:

How kind of you.

Ottoline:

The other day, when Bertrand was getting back on his bike (he always comes to see me by bike, it stimulates him, because he isn't that used to adultery), instead of kissing me good-bye, he slapped his forehead and said: "By God, the ontological argument is true!" What do you think he meant?

Achilles:

Sorry, what was that? My English is rather rusty, I'm afraid.

The Tortoise:

You might as well admit that you don't understand a word. Anyway, English hasn't been invented yet. It's a language as barbaric as Cretan. And, as all Cretans are liars . . .

Ottoline:

Okay, to put it in French, he got back on his bike, put on his bicycle clips, slapped his brow, and said: "*Mon Dieu! L'argument ontologique est valable!*"

The Tortoise:

My word! It doesn't mean much to me. Is that Boeotian philosophy, perhaps?  
What's your opinion, Achilles?

Achilles:

My word . . .

Mr. Goodman:

Enough! Enough! I'm not going to spend all my dream listening to this nonsense. Please get to the point.

Ottoline:

I think I'll make myself scarce.

*She makes herself scarce.*

Mr. Goodman:

She's making herself scarce.

Achilles:

What excellent scones. I should push away my plate.

*He pushes away his plate.*

Mr. Goodman:

He's pushing away his plate.

The Tortoise:

You've got clotted cream up to the tip of your helmet. My poor Achilles! Do you still think you can win our race?

Achilles:

Of course. I really do.

*(Singing:)*



I'm the bubbly Achilles, the bubbly Achilles, bubbly Achilles, the King of the . . . King of the . . . King of the Myrmidons!

## 76 (§ 75 continued, part 1) Act II

### Act II

#### The Tortoise:

I don't want to put you off, but I should remind you that the highest philosophical and logical opinions are decidedly unfavorable to you. Aristotle, in his *Physics*, VI, 9, 239b, 14, if I remember correctly, says: "The slowest will never be caught by the swiftest in a race, *upo tou tachistou*; for it is necessary for the pursuer, *to diaukon*, to reach firstly the point at which the pursued, *to pheukon*, started in such a way that it is necessary each time for the slower to have advanced some distance. In other words, the champion of swiftness, *to tachiston*, can never catch up with the champion of slowness, *to bradutaton*."

#### Achilles:

Yes, but there's no mention of you in all that, nor of me. Aristotle is reasoning only with abstract figures.

#### The Tortoise:

Indeed, but would you deny being the champion of swiftness? If so, it would be unworthy of me to answer your challenge.

#### Achilles:

I am the champion.

#### The Tortoise:

And would you cast doubt upon a fact that everyone is agreed upon, that I am the champion of slowness?

Achilles:

Of course I wouldn't. And that's exactly why you have no chance of winning a race against me.

The Tortoise:

We shall see what we shall see. In any case, even if Aristotle makes no explicit mention of you in this passage, he still does so implicitly, and I would be right in saying that he doesn't see you as being the winner.

Achilles:

When you can't stop a philosopher from talking, he just says the first thing that comes into his mind.

The Tortoise:

But there isn't just Aristotle. To quote Simplicius's *Physics*: "Hector would not be caught by Achilles, nor would the tortoise be." Can't you remember the day when you couldn't catch up with Hector? Homer was there, and he described the scene in his *Iliad*.

*Achilles lowers his head. Then he raises it again and hums a few times, as though working up his courage: I am the bubbly Achilles . . . then he puts on his singlet, which is marked ALPHA. The Tortoise takes off its tracksuit. On its singlet is marked: TAU.*

TAU (the Tortoise):

So, if you, the champion of swiftness, could not even beat Hector, who is just "one of the slower" and not "the slowest," how can you hope to triumph over me, the champion of slowness, and thus far greater than Hector?

ALPHA (Achilles):

Sophistry! Sophistry!

TAU:

I can see that such reasoning is beyond you. Let's drop the matter. A moment ago, you were quite willing to award me the crown of slowness. At the same time, I didn't even accuse you of bragging when you claimed you deserved the crown of swiftness. But, when it comes down to it, are you so sure? I wouldn't want to race against just any old runner, it would be a blight on my reputation.

ALPHA (*choking with fury*):

No one, you hear me? No one can say that I'm not the swiftest. And that's why I'll beat you.

TAU:

Yes, but I seem to remember that Aesop and La Fontaine had me race against the Hare (who also didn't measure up, it must be said, not to be falsely modest). So, who is the swiftest, the Hare or you? Have you ever met?

ALPHA:

Every time I suggest we have a race, it changes the subject. Just as you, apparently, are now indulging in wasting our time.

TAU:

Not a bit of it! Not a bit of it! But let's at least take the time to digest these excellent scones.

(*To Ottoline:*)

This lettuce is delicious. Could I have another leaf, please?

ALPHA:

There you go again! Listen, I don't have all the time in world. There are other races to be run, you know!

TAU:

Very well, very well. Let's get started.

Mr. Goodman:

They stand up and take up position beside the Cam, on the starting line. The two referees (ducks: Carnot One and Carnot Two) approach. The two time-kee-

peresses (seagulls: Shareek One and Shareek Two) take up position beside the finishing line.

TAU:

Of course, I shall start first.

ALPHA:

But why, in fact, when it comes down to it?

TAU:

Don't be stupid. How on earth are you supposed to catch me up if you start first? You can if you want to, of course. But in that case we might as well say that you've lost the race before you even start.

ALPHA:

Okay, okay. You start. I'll give you as much of a lead as you want: fifty meters, ninety meters, as you see fit.

TAU:

Ninety-nine meters will be just fine.

Mr. Goodman:

She rummages around in her bag, and produces an object which I can't see very clearly.

ALPHA:

What's that?

TAU:

It's a notebook.

ALPHA:

I can see that. But why do you need a notebook to run a hundred meters?

TAU:

Look, I know you're in a hurry, that you have plenty of other races to run, but, as I am the champion of slowness, it will take me rather a long time to cover the ninety-nine meters.

77 (§ 75 continued, part 2) **Act III****Act III**TAU:

I feel sorry for you. I'll give up and declare you the winner.

ALPHA (*not believing his ears, despite their length*):

I can't believe my ears, despite their length. Can this be true? You admit that I run faster than you, and that in this race, if it took place and if I gave you a lead of ninety-nine meters, I would still catch you up before you crossed the finishing line?

TAU:

Yes, yes. I give up. But there's just a minor formality. I am quite willing to agree with whatever you want me to agree with, but I don't want to look like a fool in the eyes of Messieurs Aristotle and Simplicius, as well as all of those gentleman philosophers who saw things in just the same light. You will have to prove to me, as logically as necessary, according to your hypotheses, that I must needs be beaten by you in our race, if it were run. I'll write down the reasoning in my notebook, you'll sign it, and then everything will be settled.

ALPHA:

If that's all, it'll be child's play.

TAU:

Fine. So let's set this all down properly. We shall designate by (A), if you will, the following proposition:

**(A) If Achilles is the champion of swiftness, and the Tortoise of slowness, Achilles will win the race.**

Then let us designate by (B), if you have no objections, the proposition:

**(B) Achilles is the champion of swiftness.**

And finally, if that sounds acceptable, by (Omega) the proposition:

**(Omega) Achilles will win the race.**

Everyone will accept, I think, that **(Omega)** can be deduced logically from **(A)** and **(B)**, so that if anyone accepts that **(A)** and **(B)** are true, then he or she must accept the truth of **(Omega)**.

ALPHA:

No doubt about it. A child in the first year of high school, when high schools are invented, could follow reasoning of this kind.

TAU:

But let us now suppose that someone does not accept the validity of propositions **(A)** and **(B)**; he or she would nevertheless have to accept that my reasoning is quite correct, and that if **(A)** and **(B)** (even though he or she does not accept this) were true, then **(Omega)** must be true as well.

ALPHA:

Certainly, oh wise Tortoise, if such a person existed, I could easily imagine him or her saying: **I accept the proposition "if (A) and (B) were true, then (Omega) would be true as well," even if I do not accept the truth of (A) and (B) themselves.** However, it seems to me that such a person should drop logic and take up rugby instead. And this is no anachronism. As everyone knows, or at least should know, it was we ancient Greeks who invented rugby. Now, hurry up, I haven't got all day.

Mr. Goodman:

How surprising. I must admit I didn't know that the ancient Greeks invented rugby.

TAU:

A little patience, please. Or else, give me time to run the ninety-nine meters. Now, wouldn't it also be possible to imagine another person who might say: **I accept the validity of (A) and (B) but I do not accept (Omega); in other words, I deny that (Omega) follows logically and necessarily from (A) and (B)?**

ALPHA:

No doubt. But I'd advise that person even more strongly to take up rugby.



TAU:

But neither of these two hypothetical persons absolutely has to accept (**Omega**) as being true, is that right?

ALPHA (*with a hint of irony*):

Indeed not, Tortoise. How right you are.

TAU:

Very well. I shall now ask you to take me for someone of the second category and logically force me to accept the truth of (**Omega**).

ALPHA (*dreamily*):

Can a tortoise play rugby? I wonder which position it could be given in a team: definitely not a three-quarter back. A prop forward, perhaps?

TAU:

That is not the question.

ALPHA:

So, you accept that (A) and (B) are true, but not . . .

TAU:

I do not accept proposition (C) as follows:

(C) If (A) and (B) are true, then (**Omega**) is true as well.

Such is my present position.

ALPHA:

Then I must ask you to accept (C), you can't logically refuse.

TAU:

Indeed. But first, I should like you to write all this down in your notebook, just as I have done in mine. What is there in your notebook?

*At that instant, Mr. Goodman noticed that Achilles had a beautiful, blue notebook with a cardboard cover under his arm; and he said to himself in his sleep: it must have been bought at "Marie Papier," on rue Vavin, in Paris.*

ALPHA (*blushing slightly*):

It's just a little pad that I use to note down my battles.

TAU:

I can see that there are still plenty of blank pages. So, would you please write down in your notebook propositions (A), (B), (C), and (Omega)?

ALPHA:

Why (Omega)? Wouldn't it be better to call it (D)? After all, it comes after (A), (B), and (C). And if you accept (A), (B), and (C), then you must accept (D), which follows from them.

TAU:

And why should I?

ALPHA:

Because it follows logically from (A), (B), and (C); you can't deny that, I hope?

TAU:

Not at all. It's quite obvious, logically. But let's suppose that there is a person who, while admitting (A), (B), and (C), denies that they lead logically to (Omega). The existence of such a person is possible, even if he or she must be particularly obtuse, is it not?

ALPHA:

Indeed, it is.

TAU:

So, just for the sake of argument, as they say in this country, if I were such an individual, and you wanted me to accept (Omega), wouldn't you be first obliged to make me accept the truth of:

(D) If it is true that if it is true that If Achilles is the champion of swiftness, and the Tortoise the champion of slowness, Achilles will win the race, if it is true that Achilles is the champion of swiftness, if it is true if it is true that If

Achilles is the champion of swiftness, and the Tortoise the champion of slowness, Achilles will win the race, and if it is true that Achilles is the champion of swiftness, then Achilles will win the race, then Achilles will win the race?

ALPHA:

Yes.

*Mr. Goodman noticed that there was perhaps a tinge of sadness in his voice.*

*At that instant, a duck tugged at the leg of his trousers to ask him, politely, if it was true that a Japanese mathematician had just claimed that he had virtually proved Fermat's Last Theorem, as one of his colleagues had read in The Times ( $\rightarrow$  § 81), and Mr. Goodman, on waking up, saw that Achilles and the Tortoise had vanished.*

### Scene 00

*A few months later, in October. Charming October weather along the banks of the Cam, among the tenderly tumbling leaves, and Mr. Goodman, who was again passing through Cambridge, had paused for a moment in that russet afternoon, on the lawns of his College, by the water's edge; lo and behold, he fell asleep once more and, while dozing, saw Achilles, the Tortoise, and the Hare. Achilles and the Hare were sitting on the Tortoise's back; they were both writing in their notebooks, which seemed almost full, while the Tortoise was saying:*

The Tortoise:

Have you clearly noted down this decisive step in our reasoning, which is the six million, seven hundred ninety-nine thousand, one hundred seventy-seventh, if I remember correctly?

“If it is true that, if it is true that, if it is true that . . . if it is true that . . .”

*But Mr. Goodman woke up with a start, drew up his rather stiff legs, remarked to the ducks that the evening mist had started to come down, then went into town to have a cup of tea and some scones, topped with blueberry preserve and Cornish clotted cream.*

Mr. Goodman:

All the same, I would have liked to know who won.

Ottoline:

Here are your scones, sir. The Tortoise won when the others threw in the towel during the ten to the fourteen and first round. It was in the *Court Circular* this morning.

**78 (§ 64) its “Summary of Results,” which contained various definitions and propositions without the slightest proof**

The authors of the Treatise began their great work in the firm (or at least implicitly stated) belief of having, in axiomatic set theory, a solid and permanent base on which they were going to be able to erect their majestic temple dedicated to the goddess Mathematics.

Before them, the trench for the foundations had been dug on a cliff, at a safe distance from the treacherous reaches of the ocean and firmly established by pioneering enterprises which had secured their bid (by anticipation), such as Zermelo-Frenkel, Ltd.

They would never step beyond, nor did they think it necessary to step beyond, a strictly axiomatic viewpoint, such as could be seen in what was for them an unsurpassable model: the famous *Grundlagen*, or “Foundations of Geometry,” by their god, David Hilbert.

When publishing their “Summary of Results” on the eve of the Second

World War in 1939, they warned their reader: *“This Summary contains all the definitions and all the results, but none of the proofs, from the theory of sets which will be used in the remainder of this series. As for the notions and terms introduced below without definitions, the reader may safely take them with their usual meanings; this will not cause any difficulties as far as the remainder of the series is concerned, and renders almost trivial the majority of the propositions.”*

They still deemed it necessary to announce, in this antechamber to the axiomatic palace, the construction of a metamathematical porch, which would be written and published later, and whose objective was described as follows: *“A study of Book I (Theory of Sets) is indispensable for those readers who wish to know how to overcome the logical difficulties posed by the presence of these undefined terms, and for those who want the proofs of the more difficult theorems announced in § 6 & § 7 of this summary (Zorn’s theorem and its consequences).”*

After the “the presence of undefined terms” came a footnote (\*), which read: *“(\*) The reader will not fail to observe that the ‘naïve’ point of view taken here, to expose the principles of the theory of sets, is in direct opposition to the ‘formalist’ point of view taken in the chapters of Book I, of which this is a summary. Of course, this contrast is deliberate . . . we refer the reader to the introduction of Book I for more detailed explanations . . .”*

79 (§ 78 continued) **The reader had to wait fifteen years**

The reader had to wait fifteen years. Of course, in the meantime, there was the war. But in 1948, when publication of the Treatise started once more, and at a faster pace, the Bourbakists began by concentrating most of their attention on their books about algebra and topology; it was only

in 1954 that the first chapter of their work on set theory, "Description of Formal Mathematics," saw the light of day.

Certain people were waiting for this opportunity. Those few individuals who were reasonably up-to-date with the extraordinary strides that had been made in logic over the past few years did not hesitate to make fun of it, saying that it was unreadable and, above all, pointless. This judgment is perhaps too severe, but it is true that it reads like the rapid execution of a chore.

The "formalized mathematics" declared as being "indispensable" in 1939 (but only, oddly enough, for "*those readers who wish to know how to overcome the logical difficulties posed by the presence of these undefined terms*") now seemed like a mere barricade thrown up along the edge of the precipice of imprecision (those "undefined terms"), and in the end it was enough just to advance resolutely forward, without stepping back to test their solidity.

This unenthusiastic (to put it mildly) volume creates the impression of a metamathematics that is prodigiously dull, and above all used only to give a complex form to things which are in fact quite obvious. As they say in the introduction to the book, most of the metamathematical arguments are "*the purest truisms*," comparable to this notion: "*if a bag of counters contains black counters and white counters, and if we replace all the black counters with white ones, then there will be only white counters in the bag*." Of course, there are other examples. This is a sort of street cleaning of mathematics, which may be "indispensable," but which will not keep its inhabitants occupied for very long.

Furthermore, formalized mathematics is incapable of finishing the job, because of the clogging-up produced by its terribly slow, painstaking techniques: an "assembly" of 100,000 characters being required just



to write the number 1. “[W]e could avoid all these metamathematical arguments if the formalized text were explicitly written out . . . but [it] cannot in practice be written down in full, and therefore we must have confidence in what might be called the common sense of the mathematician.” In other words, best forget it from the word go.

All this gives an oddly embarrassed tone to the Introduction to Set Theory, which is in part masked by a very “classic,” triumphal rhetoric.

80 (§ 79 continued) **But the question of certitude had still not been resolved**

For the question of certitude (with its cortege of unpleasant questions, such as that of non-contradiction: the discovery of a contradiction in the “unique source,” or set theory, would provide a sort of certitude, but at what cost?)—which is implicit from the very moment that there is talk of giving “solid foundations to . . . all of mathematics”—had not been resolved by Chapter 1 of the Book of Set Theory. And it was hard to conceal this fact. The purpose of the Introduction was thus to show that the question was both insoluble and secondary, and that the problems encountered in the impure regions of logic were seen by many as being “metaphysical,” or quite simply and scornfully “psychological.”

*“We do not propose to enter into a discussion of the psychological and metaphysical problems which underlie the use of ordinary language in such circumstances (for example, the possibility of recognizing that a letter of the alphabet is ‘the same’ in two different places on the page, etc.).”*

Such statements (and the Introduction is full of them) always remind me of this poem by Henri Michaux: “In a room of the White House,

a man was dragging his wife toward the bed. 'Do you mind!' she said. "What if I were your father? . . . See, you're worried, too."

At each step the Teutonic Knight of Mathematics, in its heavy mathematical armor, can be seen stepping across the shifting sands of philosophy: *"We shall not enter into the question of teaching the principles of a formalized language to beings whose intellectual development has not reached the stage of being able to read, write, and count."* So that one sometimes wonders: "However did they get themselves into this mess?"

It is with distinct relief that, having with a good deal of difficulty "unstuck" themselves from all these conceptual problems (at least verbally), Bourbaki readied themselves at last, near the end of their preface, and with the tone of a traveler who has surmounted every danger and survived tempests (those of the "paradoxes" in the set universe, which had arisen at the turn of the century), to leave these forever behind on their road of "formal mathematics," along which they have never found *"a contradiction, so that we have grounds for hope that no contradiction will ever arise."* Before concluding:

*"To sum up, we believe that mathematics is destined to survive, and that the essential parts of this majestic edifice will never collapse as a result of the sudden appearance of a contradiction . . . Some will say that this is small comfort; but already for two thousand five hundred years mathematicians have been correcting their errors to the consequent enrichment and not impoverishment of their science; and this gives them the right to face the future with serenity."*

Phew!

81 (§ 77) if it was true that a Japanese mathematician had just claimed that he had virtually proved Fermat's Last Theorem, as one of his colleagues had read in *The Times*

Such a sentence situates chronologically this moment of my book far more effectively than if I had added the date of composition, or else introduced directly or indirectly a reference to its position. It stands as one of the contingent details that punctuate the temporal progression of my narrative from its very beginnings, dated explicitly as being in 1985, and which mark the incursions of the present of its being written: an event, which is now in the past, still existing in an unpredictable future; in this case, the announcement of the proof of Fermat's Theorem, about which the duck asks Mr. Goodman. This question dates the writing of this moment as being prior to June 24th, 1993.

If I'm picking up on this particular coincidence, rather than on some major historical event (as I could have done, at least in terms of the years in question, with the final, inglorious running down of the Soviet flag during Christmas night, 1991; the beginning of what has been called the "Gulf War"; or, more recently still, from my current perspective, the outbreak of horrific fighting in Bosnia) in order to attract my readers' attention (or try and force my readers to focus their attention there, for a moment, I should say) toward this particularity of the book they are reading (I imagine a reader reading it, once it's been finished and published, with any luck under the same editorial colors as the previous branches)—in other words, that it is, intentionally (as all writing is, however unintentionally) written in the present, visibly accompanied by and interwoven with the present of its composition—then this is because it concerns an event in the history of mathematics, and is thus more naturally associ-

ated in my mind with the reconstitution of my years of mathematics (of mathematics as a part of my **Project**) than other events might be (likewise, the fall of the Berlin Wall did, as I mentioned in branch two, “precipitate” me into a chapter by helping to bring out a few of my memory-images of the Second World War).

It was on the morning of June 24th of the present year (1993) and as usual I had, before taking the number 27 bus in the direction of the Luxembourg Gardens, bought a copy of the *Times* from the “Relais H” kiosk in the Cour de Rome part of the main concourse of Saint-Lazare station, which is the only kiosk on my path that happens to sell foreign newspapers. It was just before eleven o’clock. As I removed the paper from the display (which also featured its colleagues and rivals in the same product category of so-called “quality papers”), my eye was caught by the right-hand corner of the front page of *The Guardian*, which was a little lower down, and on which I read:  $x$  to the power  $n + y$  to the power  $n = z$  to the power  $n$ . An intense emotion gripped me, because the presence of this equation, which was otherwise totally out of place, could mean only one thing: something had occurred to do with Fermat’s Theorem, and this something was important enough to deserve a journalistic mention.

I bought *The Guardian* and opened it at the foot of the escalator that runs down toward the Cour de Rome, just opposite the terminus of the number 20 bus (as I think back, I can picture Raymond Queneau in the same place (because of *Exercises in Style*)). The first page of Part 2 of the paper, devoted to “cultural news,” could not have been clearer. Above the table of contents, it was almost entirely taken up by another “table” of 23 lines of 5 columns, each element of which reproduced in gray italics the sacred equation:

Right in the middle, printed in bold capital letters over almost three lines of the table, could be read:

That was all. But it was enough.

82 (§ 81 continued) **A little before ten thirty, yesterday morning,**

A little before ten thirty, yesterday morning, said the article I read on the double inside pages of the paper, which described the circumstances of this incredible event, Andrew Wiles, aged forty, of Princeton University, shown in a photograph wearing a dark pullover in front of a blackboard (an example of the usual board covered with undecipherable jottings (which, even if legible, would have been incomprehensible)), smiling, wearing glasses and a tie, his hair already receding across his skull along two gulfs, which surrounded on both sides a promontory still decked with a capillary presence, standing in front of the indistinct spheres of heads making up a doubtlessly intellectual audience

(this homothetic photograph (in a fractional relationship (denominator superior to numerator), modesty-wise) to a reproduction of a be-wigged portrait of Pierre de Fermat, of the Parliament of Toulouse, positioned in the center of the double page), had, at the end of a two-and-a-half hour presentation entitled “Modular Forms, Elliptic Curves and Galois Representations,” put down his chalk at the bottom of the blackboard, turned toward his audience, and said: “I will stop here” (according to Enrico Bombieri, Fields Medal, likewise of Princeton (one says, “X, Fields Medal,” as one used to say, “Lieutenant Y, Military Medal”))).

The audience at the Isaac Newton Institute of Cambridge (England) held its breath. Of the six people in the world capable of understanding Wiles’s proof (I shall leave the entire responsibility for this assertion to Andrew Granville, Associate Professor of Mathematics at the University of Georgia (USA), who was the informer for *The Guardian’s* article), five (including Bombieri) were in the room;

and, as Wiles’s words tumbled into all those mathematical ears, and the general direction of his thinking as well as the final aim of his efforts



became increasingly clear, the questioning glances from the other members of the audience, who were less able to judge how valid his reasoning was, turned toward them (I suppose) to gauge their reaction. There was a moment's silence, followed by thunderous applause. This venerable fortress had fallen at last—perhaps—after three centuries' efforts.

Bus number 27 was driving alongside the Police Prefecture, on Ile de la Cité, when I set the paper down onto my lap (I was sitting, as I often am, in the second, rear, carriage of the bus, in the seat immediately to the right of the exit (two three-place seats face each other between the door and the transition “drum” that connects the two carriages). Some indifferent (?) gulls were just then ripping (??) into the Seine).

As soon as I got off the bus, on Boulevard Saint-Michel (at the stop between Gibert's book store and Lycée Saint-Louis), I went into the first free phone booth and started calling. I rang Marie at her factory. I rang Charlotte in Montpellier. I rang Paul Braffort, of the Oulipo. Claude Berge, of the Oulipo, who wasn't in. Pierre Lusson wasn't in, either. I left a message with Yuka, his Japanese daughter-in-law, then I called him again at his daughter Cécile's so that he could inform Jean Bénabou, who wasn't at home, either. After these phone calls, I felt a little calmer (→ Bif B).

**83 (§ 69) when going from one to the other, from A to B, you went through a room mainly inhabited by Russian books**

If a library is a territory, then its classification numbers and their positions form a map. In this library, as in many others, the counties, towns, and villages are named by letters, groups of letters, by formats and numbers, while the countries are floors, for example the sixth floor of store B, or the second Turgot basement.

A given classification number is like a street gradually invading a countryside of ugly, gray shelves, and the chronological growth of collections with the same classification numbers is like making a building taller, with a floor being added from time to time. If each book is a dwelling, a house, a palace, or a cottage (the duodecimos are shacks, the folios castles), their architectural materials are no less varied, from covers of thick cardboard down to fragile paper, with frivolous, negligent, or severe designs and typography. Some are unfinished, such as the most recent “years” of periodicals, with their rough casting and surfaces still to be finished (bindings), kept in bundles between two pieces of card secured with string.

Over the years, I’ve acquired an increasingly precise and varied geographical vision of this land; “precise” because I often return to the same places; “varied” because my reading interests often shift, according to a sort of multi-annual rotation of my work and my passing passions, even if there are entire regions I shall never explore. In a region that I already know a little, I advance with a reader’s irrepressible curiosity, justified in my own mind by Warburg’s law of the good neighbor. I have thus made many discoveries, and not just among the recent acquisitions, the “new purchases” that stand out for miles on an often dark shelf, on a particularly ill-lit floor, revealed by the sparkle of their paper or a cover that has not yet been dulled by time, by handling, or of the depression suffered by books whose users demonstrate a tragic disregard for them, with dust as its corollary.

The countryside changes constantly, under ordinary circumstances slowly but surely, because, after all, shelves fill up and space runs out for a given collection or classification number. It’s then necessary to extend, change positions, rearrange (but not, I hope, remove, eliminate, and destroy, as is too often the case). I can easily take on board the progression

of purchases in the regions where expansion is swiftest. But far greater disturbances can occur, when absolute saturation is reached, and I then have to revise my mental image of that ancillary memory representing, for me, the library as a whole.

This memory is crisscrossed with the journeys I make to reach the books, the awkward stairs I climb to get to them, the darkness that conceals them, the tactile recollection of the moments I pick them out of their hiding places and take them away. My connection with the books of the Bibliothèque Nationale or the British Library is far less familiar and physical, far more abstract. I sometimes have their books at my disposal on my table for several hours, or even a few days, but I know nothing of their living quarters.

A library also has its old quarters, its treasures and ancient monuments: its rare or extremely old books. Their place, after a decision has been made to "classify them" (rather like the preservation and freezing of seventeenth-century town houses, "Art Nouveau" buildings, or Romanesque churches), is the Reserve. For many years very many volumes from the sixteenth and seventeenth centuries were as freely available for borrowing as their modern comrades (which must have assisted in a large number of disappearances). Thus, less than twenty years ago (was it because the Sorbonne's Italian scholars were at that time more apathetic than some of the colleagues, or simply more honest?), I had a first edition of Ariosto's *Rime* (among other marvels) at home for several weeks! (My joy was immense, but my grandfather's shadow finally overcame my selfishness as a reader and I public-spiritedly informed the proper authorities of this anomaly; they started by first preventing these books from being borrowed, and then finally removing them from sight.)

84 (§ 70) **I do not read the same things in different sorts of places**

It's as if a genuine division of reading labor has established itself gradually over the years. Of course, its origin is partly pragmatic: like everyone, I have to take into account the bulkiness of a book (the very large tome, for instance, of Victor Hugo's complete poetic works in the old Pauvert edition is just not well-suited to a bus ride. Books' formats influence the manner in which they are read. It was to make reading on horseback possible that Aldus Manutius invented the pocket-sized book, in about 1500). I must also, like everyone, take into account the availability of books: some sorts of reading can be done only in libraries, and this can even entail traveling (to London, of course, as far as I'm concerned. In this case, I could even say that the books I convince myself that I must read are sometimes chosen to justify the trip).

But basic, practical reasons can't explain why, for example, it is so very hard for me to imagine reading a novel in a library, even when it can't be obtained elsewhere (because it's out of print or overpriced). In order to overcome this baseless prohibition, I need a pretext or a piece of mental sleight of hand (the idea of a possible work of poetry somehow utilizing said novel; this isn't easy and, as a result, I almost never have recourse to such legerdemain).

Thus, the place of reading influences what is read: for novels, the train; but also all the places that can be reached from where I live, on rue d'Amsterdam—cafés, or public benches when the weather is good enough. I tend, of course, to see this association with movement as being quite natural. A narrative implies time, and its continuous passing, and the continuity of time is measured by spatial movement. Implicitly, I accept novels only as journeys.

A few years ago, I had succeeded in maintaining a very clear division between different families of books, associating them with different families of circumstances in an equilibrium that was quite satisfying, if rather severe. But this rigor has since tended to dissolve; I see here the effect of the aphasia of age.

A corresponding separation, but which in this case has tended to become stricter, divides the things that I write: prose on the computer screen; the screen also for setting down other thought processes; arithmetic sitting at a table.

But for poetry, I need my hand, used in the old-fashioned way, tracing signs on paper, after the signs have already been shuffled and turned about by my inner, but almost audible voice. I thus need absolute isolation for this absolutely private action, and also a ferocious immobility of thought: closing my eyes, moving my lips like Rex Stout's detective Nero Wolfe, the orchid man (I should work on trying to do it like him: sitting while *"leaning back with his eyes closed, his lips moving now and then, pushing out and pulling in"*; I would thus show all the signs of brilliant poetic detection, though I would alas have no Archie Goodwin as my witness: with myself alone to serve as critic, an undoubtedly essential doubling of personality).

**85 (§ 70) her violet rays, the alpha and omega of my desire, which she dispensed so generously to all the world's indifferent objects**

To say that all I desired was for her to return my gaze is not quite true; I had more specific desires, focused at a far lower altitude than the vertiginous light of her eyes. I liked to daydream about changing at the Gare de l'Est (where I left the Orléans-Clignancourt line) and instead of going

down to the Pré-Saint-Gervais platform (whose departures were in the direction of Mairie d'Ivry at the time), changing onto hers.

I could see myself beside her, speaking to her, saying, as in the Alphonse Allais tale: "You have beautiful eyes, Mademoiselle, especially the left one." (It was the "right one" in the story, but borrowers should always display a little originality.) She would reply I know not what; but she would reply because in fact she had been waiting for me to approach her for so very long; and the extremely negative attention that she had paid me thus far, so as to exclude me from her field of vision, had not been proof of her obstinate indifference but, on the contrary, of the perfect clarity she had acquired of the contours of my image in the violet chambers of her gaze, whenever I wasn't looking at her; in fact, the precision of her uninterest proved her interest; my dreams were born from such reasoning (→ § 86).

We would have talked, then left the metro rapidly before going at once to her room (she would have had her own room, and let me into it discreetly); finally I would have plunged my eyes into hers, into all of that violetness suddenly become promise and permission; I would have plunged my hands into her clothes, toward all of those fleshy marvels they would have enveloped then developed as they fell.

Many self-propagating details gradually proliferated in this interior narrative, designed to combat both the slackening of the tension of desire and the acceleration of my fictional erotic experiences, encouraged by their repetition, and endangering the continuation of these reveries; so I lengthened our conversation, I delayed my explorations, the ensuing discoveries, the tumbling of soft fabrics, and the conclusion. Without realizing it, my imagination followed the advice Gauvain gives to Yvain in Chrétien de Troyes's *roman*: "*The joy of love delayed is like the green*



*log that burns and gives an even greater heat for being slow to ignite.”*

(But green wood tends, if I am not mistaken, to produce smoke when it burns.)

The fixed point of departure (my metropolitan bifurcation) also fixed the luxurious point of arrival; I often had to abridge my narrative because of the untimely and premature arrival of one or other of the antagonizing trains (hers or mine; I needed her actual presence in order to ignite her imaginary future nudity behind my impassive brow, and, above all, above all the relative proximity of her big, ever-evasive eyes on the far side of the tracks. And I would punish her for such unfavorable contingencies by adopting an abrupt variant in which I would drag her into a sleazy hotel bedroom on rue Faubourg-Saint-Martin. I knew nothing about sleazy hotel bedrooms around railways stations, but I did my best. (All the unspoken ideas about such places were quite enough)).

I didn't indulge in this "role play" every evening. It occurred above all on those evenings when, in the silence of the Sorbonne library, my helping of topological effort had been particularly copious; when I had struggled with an especially arduous theorem, or an obstacle that had long been impassable; when I had had the already sensual jubilation of having overcome it. The longed-for ravishing of the young lady with violet eyes would be, in a way, my reward.

**86 (§ 85) the precision of her uninterest proved her interest; my dreams were born from such reasoning**

As the submersion of my narrative of memories into this rather shallow track (which rapidly leads to a dead end) has forced me to evoke these images of the metro over and again, and in detail, I have only just no-

ticed (in the present tense of the text) an obvious point that completely escaped me at the time, namely:

I invariably chose to wait on the platform facing the tail of the train, with behind me the escalator that descended from the footbridge over the tracks (I had just taken it). The reason for this has an analogy in the laziness that the principle of geometric optics discovered by Fermat attributes to light: in all circumstances, always minimizing the length of its rays and trajectories; taking the shortest route. If I always used to take the last but one door of the last carriage, it was because the exit from Bolivar station was at the rear, and I tried to get out onto the platform first (the last but one door is better placed for rapid exits, for kinetic metropolitan reasons I shall not go into here).

Now, this troublingly unvarying young lady, with her eyes of almost marine iodine, always stood (at least my memory places her invariably in this spot) exactly opposite me on the other platform, ready to get onto the first car of her train, using the next to first door of the metro, which would then take her who knows where (in any case, in the direction of Mairie d'Ivry), thus ready to get off at one of the stations where the exit (or one of the exits at least) was at the front (which greatly diminished the number of possible destinations) (and her choice of standing in front of the penultimate door of the first carriage was even more justified than my choice of waiting in front of the last but one of the last carriage, because the metro trains at the time, as opposed to the rule nowadays, were under the responsibility not only of a driver (driverless trains, like those in Lille, were still the stuff of science fiction (and should have remained so; I always feel illogically worried about getting aboard a vehicle without a human driver)), but also of a second employee in a cap, who was the train's conductor and who controlled the opening and closing of the

doors (while checking that his train respected the basic, official axiom expressed in a classically metric distich (alexandrine + octosyllable) **“The train can only leave once its doors have been closed / Do not obstruct their closure please,”** he sometimes had to go up and down the platform to guarantee the latter point, pushing aside the extraordinarily elastic mass of passengers); as his observation post was at the very first door, he generally kept passengers from making a speedy egress onto the platform).

If the primary explanation for her refusal to grant me for even one second the luminous, violet benefit of a single glance was an uncontrollable aversion for any proof of my interest, why didn't she simply change her place on the platform, moving down a carriage or two, even for just a couple of evenings, to demonstrate her rejection for me clearly and manifestly, before moving back to her initial position, once the message had been sent? In this case, I'm sure that I would have immediately abandoned my quest, and my place on the platform. And I would have forgotten all about it at once.

Her obstinacy, if I take into account her evasive strategy, was blatant and proved beyond doubt that she knew that I was trying to attract her attention, and thus could have had only one of two main rationales: the first, and certainly the most likely (the one I had accepted unthinkingly until today) being that she simply refused to budge an inch;

the second being that she would not in fact have refused to make my acquaintance. This idea never even occurred to me consciously. But things are perhaps best this way, because I never had any regrets (never saying to myself: “Oh you whom I would have loved.—Oh you who knew it”).

**87 (§ 71) I read and reread these definitions countless times, without understanding anything, literally without understanding anything**

I have a clear recollection of this incomprehension. I also know that I came to understand these definitions (and the remainder of the chapter, as well as the entirety of the others) and would understand them still, almost immediately for the most part, if I read them again; the chain of their reasoning is familiar to me, and is perhaps what is most familiar to me in the entire Treatise. What's more, I could not fail to understand. In this case, the irreversibility of comprehension is entire. But the remembrance of my incomprehension is far greater than the deductible knowledge of the fact that before understanding, I must not have understood.

What my memory inexorably presents to me today, when I think about it hard—when, by the force of thought, in front of my nocturnal screen, this early March morning, I put my former self back into that very place which is so vividly clear to my inner eye—is this rationally impossible and even incomprehensible thing: the memory of my mind being full of the absence of understanding of what a topological space is.

I try to think of it. I imagine. I imagine myself in that place (the memory of my initial, prolonged incomprehension of topology leads me to remembering myself being exactly there, the memory arises of its own accord before my eyes), I imagine myself today opening the book (I can see its pages) and likewise suppose (I pose this thought experiment) that what I am reading—some other thing, for example the supposed draft (which the mathematical world is currently waiting for with intense impatience) by Andrew Wiles of his proof (which shall perhaps finally be complete and free of gaps) of that part of the Shimura-Taniyama-

Weil conjecture which is required to imply “Fermat’s Last Theorem”—is something that I will not understand at all.

Ignoring the many and obvious differences between the two situations, I imagine that what my memory today reconstitutes for me, in terms of my incomprehension at the time, can be reasonably inferred from what I can suppose, no less reasonably, I would feel at the moment of contemplating the opening lines of the proof of Fermat’s theorem in a presentation meant for those who need no preparation for understanding it.

I could quite easily, arguing with myself as I am doing now, say to myself, yes, that’s just what your memory of your encounter with the notion of topological space was like (I am addressing myself in the second person for the purposes of this narrative (in reality, I use no pronouns at all when talking to myself)), and the immense perplexity at the bottom of the pit in which it left you for so long was very probably of the same sort as what you imagine now (with the help of your memories of other, similar occasions later on, all equally impossible to reconstitute rationally via recollection, while also quite as obviously seeming to have really happened and thus to have been recorded by memory).

In consequence, I say to myself, it’s not possible for you to reconstitute something like a non-empty approximation of this memory (which you are absolutely sure is true, at the very moment of expressing these doubts, and truly present in you right now) without the help of one or more imaginings (conditional memories of a hypothetical future situation); that these imaginings, insofar as they are now possible for you, prove the possibility of your memory, because you think that they belong to the family of thoughts that come from memory, that they are constructed by memory, and thus in the end that your memory is imaginary, and more precisely that any memory (to generalize wildly) is constituted

and reconstituted constantly by a swaying (perpetually shifting along the axis of before and after) between the past and future, or between recollection and imagination. But is this not precisely what you (I) wanted to get at in this interpolation: an informal example of what was to have been the mathematics of your (my) **Project**, such as your book is supposed to be evoking, as its justification?

**88 (§ 72) mathematics could be paraphrased (and is the thing that can perhaps be paraphrased most easily, even with certainty), and as such was situated at the greatest possible distance from poetry**

I can see quite well in what respect this statement is too absolute. The things that can be paraphrased in mathematics are the safe, established, completed subjects, which are now taken for granted. This part of mathematics can be paraphrased in its entirety; and such recapitulation always needs doing, and doing in new ways: paraphrasing its concepts, statements, and states is an essential task, far more essential than many of its adepts think, so that this activity is often seen as being secondary, minor, didactic (or worse, introductory and educational).

The necessity to transmit information necessitates this process; it is always necessary to try and reduce the ever-widening gap between those who make theories progress and those who are trying to progress in their own understanding (at all stages of their apprenticeship, from playschool to university and, as they say, in the hereafter). (Since the beginning of the century, an indisputable acceleration in the distancing of these galaxies has been noted.)

But this work of paraphrasing is just as essential for the advancement of mathematics itself. It is thanks to this very operation of re-expression



that most progress becomes possible. In this respect, mathematics is also a great art of language.

The part of mathematics that cannot be paraphrased appeared to me (thinking about the failure of my **Project** and the novel that was to shadow it (it was a math project as much as a poetry project, both of which were to be understood with this in mind)) as the part of it that had not yet been discovered, the *terra incognita* of theorems still to be proved, or territories to be redrawn perhaps; it represented what mathematics had not become, its future, with an unforeseeable side, which its visionaries, like David Hilbert, tried to reduce with their conjectures and anticipations.

At the same time, I saw poetry as something that essentially cannot be paraphrased; and its non-paraphrasable element is thus poetry itself. (What can be paraphrased is, at best, didactic while remaining a mere component—and hardly the most important one—of what is transmitted.) Poetry is, always, future. It can be approached only in the future, and yet there is no poetry that needs to get done, there is no “Hilbert’s program” of poetry; there are no conjectures in poetry. All there is in poetry is already there; and this poetry is all there is, it is there in front of us, in the future of our reading. (Even the poetry that is farthest away in the past is just that.)

For my **Project**, in the stretched arc of my **Project**, mathematics was to be placed as far away as possible from poetry; I was to establish that poetry cannot and must not be paraphrased (which means that there’s no point taking it up as a subject to be studied). Poetry does not move; all that moves are its effects inside of us, the effects of our memories. (It is no doubt for this reason that I feel the texts of older poetry should only be altered as is strictly necessary in terms of their being able to penetrate

the people we are now; I feel that something of the ancientness of all poetry should be preserved, thus giving us its present and at the same time a memory of its previous play with language.)

**89 (§ 72) Subsequently, I was to encounter no more insurmountable problems when reading a volume of the Treatise, including the exercises**

Little by little, I started not only trying to solve all the exercises in each paragraph and then chapter, including those that the editors had decided were difficult, and had marked with their redoubtable “flag,” but I also started to write out the answers and finally (but this was just before I totally abandoned the Bourbakist view) conceived of a project for drafting a “full set.” I imagined a book, modestly (and prudently) photocopied by myself, entitled: Contribution to the Solution of the Exercises of Mr. Bourbaki’s Treatise—Paris, 19—, printed by the author (who accepts sole and complete responsibility).

A few days ago, I attended with my friend Lusson and my old colleague and friend Leborgne (specialist in Non-Abelian Cohomology; we very rarely see each other; he lives and teaches in Nantes) Maurice Loi’s philosophy and mathematics seminar given in homage to one of the founders of Bourbaki who had recently died, the great Jean Dieudonné. The speech in his honor was delivered by another (now old) Bourbakist (whom I have described in his attempts at didactic persuasion during the 1950s in § 38–41), Laurent Schwartz.

The Dussane room of the ENS was full; in the first row sat Mme Dieudonné along with members of the family, and there could also be seen another founder of Bourbaki, Henri Cartan, the inventor of the very

filters that provide the pretext-image for this chapter. For my story, the circumstances were perfect. Sitting just behind us (Leborgne, Lusson, and me; we had excellent seats because I was the first member of the public there, an hour before the session was due to begin (first member of the public, but not the first person present, because our host, Mr. Loi, had arrived I have no idea how long ago before me, and was sitting alone and bald in the huge, comfortable, and not at all mathematical hall (it was a theater))), just behind us, then, was our old teacher Choquet (→ chap. 1).

Schwartz spoke, and spoke. The many young mathematicians who, that evening, had decided to attend out of an almost archaeological curiosity to contemplate survivors from an already legendary era of mathematics, the Bourbaki époque (the session started with a screening of an episode of the now defunct book program, *Apostrophes*, onto which Jean Dieudonné had been invited after publishing, shortly before his death, a book with the fearsome title *In Honor of the Human Spirit*), were sometimes gripped by nervous laughter. So were we, but our laughter was probably due less to amused astonishment than nostalgia, embarrassment, regret (oh years scattered with deaths, defeats, and monsters!).

During the war, in 1941–42, Schwartz and his wife Marie-Hélène had attended Dieudonné's lectures at the college of science in Clermont-Ferrand (where the University of Strasbourg had taken refuge). Later, when the war was over and Dieudonné was appointed to Nancy, he took along his former student and new member of Bourbaki to this city that was to become the kernel of the new way to go about mathematics. "We had few students," Schwartz recounted, and went on to say words to the effect of: "They were not very good. Dieudonné failed nearly all of them at the end of the year—so to give us at least a few people for the more advanced

classes, Henri Cartan, who at the time was in charge of the ‘mathematical life’ of the *Normaliens*, used to loan us a few of his pupils for a year. Those were the days. We worked a lot, but still had time to go to concerts and the theater. It’s even said,” he continued, leaning down toward Mme. Dieudonné, who was sitting in the first row just in front of him, supported by family members, “that the two of you met at a concert.” Mme Dieudonné answered something inaudible. “That’s right,” Schwartz went on, “*vous êtes tombés amoureux.*” (“You fell in love.”) “No, no!” Mme. Dieudonné replied, distinctly and audibly this time: “*Aux concerts Lamoureux!*” (“At the Concerts Lamoureux!”)

But the finest moment of the evening, incontestably, was when Schwartz told of an unforgettable meeting that had occurred on a bus in Grenoble, one day in 1943. It must be remembered that Elie Cartan, Henri’s father, was one of the greatest French mathematicians of the early twentieth century (among other things, he showed in 1922 that the “Einstein tensor” is not the one that could most generally be applied to the more general solutions of the equations of general relativity, but instead a more general tensor, containing an extra term, in which first appeared the mysterious cosmological constant). He was also one of the few whom the generally iconoclastic (in their youth) Bourbakists, impatient and ready to shake the foundations of mathematics, venerated for theoretical as well as familial reasons. Now, after the German occupation of the so-called “Free Zone” in November 1942, the Schwartzes had gone under cover for obvious reasons and were living under assumed names in the Grenoble region. One day, Elie Cartan got onto the same bus that they happened to be riding on. Spotting Schwartz, who had been one of his students, Cartan hailed him and said something along the lines of: “So, Schwartz, I hope they’re not bothering you because you’re Jewish. That

would be scandalous!” Having heard the tale of this meeting with my own ears (and it is worthy of Christophe, the creator of the unforgettable scientist Cosinus), how can I still claim that mathematicians are not all scatterbrained?

90 (§ 73) **I can at once see something like an icon of topological space, a kind of broad grassland of “points,” each positioned above a filter-cup**

This image is also related to that of the grassland on the screen of my Macintosh LC, which is accompanying and supporting me during this branch; an already “obsolete” model (just like my “moment” as a mathematician, like my understanding of mathematics); with its flat face (in reality, slightly convex), this machine receives my confidences and then stocks them in a topological space that is rather a mystery to me: “files” fitting one into another, containing “documents,” which contain texts, which themselves include paragraphs, sentences, words, and, finally, their pixels.

But it is the representation of an actual grassland, with its grass transplanted from memories of the actual world (the natural world), which dominates my vision. The “points” are in this case pure coffee beans, but infinitely small, infinitely black and liquid ones; and in each (and every) one we find its own neighborhood filter converging (such coffee is more-than-just-*stretto*, for at the bottom of the cup there is nothing but a concentrated, quintessential, and absolute point of coffee). These are the limit points of a virtual liquid pouring down perpetually from the vast sky, which is the “entirety” of space, all of it, all the universe, the greatest neighborhood, common to us all.

So, why grass then? It's not part of the space in which the drops of quintessential, topological coffee (of the Henri Cartan brand) are the points. No, the blades of grass take the part of the infinitely proliferating neighboring points, and see to their separation. They are non-standard blades, grains of the dust of silence (silence alone is made up of infinitely small contiguous points; all audible sounds are discontinuous, separate, discrete). This grassland isn't really topological space itself, but a (fallacious) representation of the idea of "completion."

If I linger over it a little too long, the landscape shifts toward something else, toward a narrative prop; it becomes a "Carrollian" landscape, in which a unicorn comes to drink from the various coffee cups, with a single straw beneath its single horn. It upsets the topology, of course: the points stop being limit points, and many other changes occur, bringing with them horrors contrary to any reasonable axiomatic system.

Below the grass, below its surface sown with cups, lies the earth, invisible and virtual, as black as Chernozem coffee. The earth is utterly invisible and escapes this space as I imagine it; it fills a different one.

Or else I imagine it as the dark "double" of the space I've summoned up in my vision, like a lightless copy of that space, an object occupying a symmetrical position to it, on the far side of a mirror, which would invert not only the figures, but also the respective roles of black and white (a photographic effect); I imagine it as the "dual" space of the first. There are galleries of moles converging toward the points on the surface: the cups could be little volcanoes of earth being expelled from the ground. Such is the irremediably frivolous, mathematically irresponsible scenario with which I accompany the idea of topology in my thoughts (this scenario was created a long time ago and gradually modified by the irruption of new concepts, such as those that have given new life to the possibly Lieb-



nizian idea of the infinitely small). But what can I do? It is not easy to govern what inhabits our inner space and its environs.

**91 (§ 73) The most perfect of these singular beings were those that “converged toward a limit”**

Such were the neighborhood filters in my scenario in the preceding interpolation (the neighborhood filter of a point having this point as its limit). But there were filters without limit points, where the conclusion of the process of convergence led to something that was not in fact a point.

For these marvelous, limitless filters, I had an entire store of other depictions. For example, there could be two or several points of convergence, resulting from a sort of suggestion for alternative orientations in the pouring of the coffee, which would then fall into two or more distinct cups. Why not? Why deny yourself an inch of fantasy in these deductive, imaginary landscapes?

However, the example that lay farthest from the ordinary situation was the one that I could represent to myself only as a catastrophic deviation: faced with the slow dripping of the topological substance (the atomic sequences of the caffeine corpuscles) from the filters, having gripped their filter-cup in my fingers (as often happened to me with ordinary coffee filters in cafés or in trains), it was so scalding that I let it go and the liquid ran away into the grass, then below the grass into the ground, lingering for a moment in the form of an indistinct, continuous, brown puddle of coffee-points totally devoid of any separation.

Here again, the scenario becomes increasingly Carrollian, since I seem to need to represent it to myself, miniaturized inside me (in the suppos-

edly physical space within the mind (which is perhaps utterly illusory) where such a scene establishes itself), gripping a mental cup in my ordinary fingers (just try and carry out the same operation).

I could easily (at the time when I was keen on general topology) vary the landscape so as to take into account the different sorts of space, according to their properties (connexity, compactness, local connexity and compactness, etc)—adding forests and deserts that would coexist with every sort of body of water—by sending projectiles from one of these regions to another (each being a space in its own right): clouds of arrows that would travel from the points of the first to the points of the second, either reaching them or not, and so on: the “morphisms” of a “category” (or of another). The fantasy world thus created taking on life (notice that my imagination remained intentionally rustic).

After all these gymnastics, lying down on some real grass would have been infinitely relaxing.

92 (§ 74) **All of this was beautiful, strange, and dazzling; it dazzled me; yet it did not satisfy me**

It wasn't just that the initial example given in the Treatise of an object's being “open” or “closed”—that is to say, a segment of line deprived or not (respectively) of its boundaries—was small-minded, and as such seemed to contradict the spacious and tortuous image of this environment I had formed thanks to the strangest inhabitants of that land called “topology” (which also had to accommodate “teratological” spaces, quite unlike the nice, reasonable, so-called “real” straight line), but that my imaginings placed all these examples at my disposal (as presented in the Treatise, or else constructed in the solutions to exercises) all at once, within an interior

visual field (of perception, of thought, and of memory) that (though I was incapable of saying exactly what it was (and I think today that it has at least six dimensions (eight if I include time))) was not at all unidimensional.

Furthermore, this space, soaked with time, didn't even seem to me to be "closed," but indeed to be "open." I was faced with just the same difficulty when I tried to think of time itself as being closed. A closed time is conceivable but not inhabitable by our thoughts, if it's to be seen at the same time as it's being conceived—and yet, time is indeed closed; it couldn't be otherwise. And my inner space too, as a motionless field, must be closed, if it's true that it is entirely interior to my body.

The rational conclusion that leads us, bound and tied, to separate the inside from the outside turns it into a closed-open space, a piece of the entirety of space, a sub-space, a disconnected space, to which we provide the infinitely thin frontier of our skin (but not our real skin, an imaginary skin without any depth).

The fact of having formed, right at the start of my explorations of topology, a vision so unlike the one that acted as the original inspiration for this discipline (because, by following Bourbaki, as I have pointed out, I was proceeding from an extreme generality that was utterly unhistorical) led me, without noticing, to become gradually accustomed to submitting to this concept the interiorized space of the world and my own perception of time, but also more generally to think about the field of memory in such terms.

In the distance, perhaps, there is an end to space in every one of its directions: up and down, left and right . . . and one as well for the two temporal dimensions of before and after (which are both in front of me, proceeding from the point at which I conceive of them), but I can never reach these walls, and so I refuse to set them up before me.

I am possessed by a personal Zeno who spontaneously shows me that the end of time is impossible (and above all the end of *my* time, whatever I may know), and is impossible because my thought throws it back to infinity; my time can be counted only in **clours**, the temporal durations of clouds in motion, which are forever slowing down and thus never reach an end. This also was the idea behind the ancient myth of Meander.

**93 (§ 74) This is, I think, what happens in the memory, when one tries with difficulty to separate different recollections**

I realized this much later, when thinking about the topology of memory and of inner time (and I started doing so far more precisely when I got it into my head, in 1985, to write what this is now a part of, and to write it in time, following time); it seemed obvious to me that the properties of weak separation (Fréchet's axiom gives one possible example of this, and the standard theory of topology cannot provide the sole conceivable description of it) have infinitely more verisimilitude than those of strong separation. I wouldn't say that this is necessarily an accurate description of the facts, but it provides an idea of the mechanism of memory that is far more accurate than the notion which states that it's possible to isolate them clearly, one from the other.

For the trajectories of memory have not only a strange reversibility, within the very multiplicity of their possible directions, which create a feeling of overall indirection

(beginning to remember at a point in time that is always in fact imprecise, through an image which is, so to speak, from no moment, given that it could come from so large a number of them, a second image then succeeds it, which the first apparently summons spontaneously, as though it must come afterward).

But if, on the contrary, the second image happens to be evoked first, we will then go quite as spontaneously, via the well-trodden path of memory, in the other direction, toward the first. The respective chronological positions of these two images often escapes us; but, even if we manage to date them exactly, we can still follow the route that connects them just as easily in the opposite direction.)

but their succession, in a given sequencing, is not at all a point-by-point succession that can be separated in twos, by neighborhood (memorized scenes), without any common points. Among the neighborhoods that contain them, there is always an overlapping (such is my experience), and it is because of the existence of these overlappings that I can pass from one memory to another,

more generally than I can obtain even a minimal access to an actual rereading of the past.

## Bifurcation B

### *Marginis Exiguitas*

94 (§ 82) After these phone calls, I felt a little calmer.

*“Cubum in duos cubos aut quadrato-quadratum in duos quadrato-quadratos et generaliter nullam ad infinitum, ultra quadratum, potestatem in duas ejusdem nominis fas est dividere.*

*“Cujus rei demonstrationem mirabilem sane detexi; hanc marginis exiguitas non caperet.”* (“It is impossible to separate a cube into two cubes, or a fourth power into two fourth powers, or in general, any power higher than the second into two like powers. I have discovered a truly marvelous proof of this, which this margin is too narrow to contain.”)

“The proof won’t fit into the margin.” We can only wonder who Fermat intended this remark for, which was itself a piece of marginalia, placed among others. It was not, as in popular legend, a letter to one of his many correspondents, but instead one of his enigmatic, precious commentaries written on his copy of “Diophantus,” translated by Gaspard Bachet de Méziriac. For himself, no doubt. But only for himself? In preparation for an edition of his Works? This is not very probable, given the extremely casual way he had always dealt with the question of publishing and preserving his results. After his death, in 1665, his “Last Theorem” remained unseen. It was only in 1679, thanks to the pious efforts of his eldest son, Clément-Samuel de Fermat, who republished



Bachet's book as a prologue to his father's Works, while adding to the translator's commentary on his version of the "six books" of the "father" of arithmeticians, the "Alexandrine" Diophantus, the "observations" that his own father had contributed ("*Diophanti Alexandrini Arithmeticonum libri sex et de numeris multangulis liber unus cum comentariis C.G. Bacheti V.C. et observationis D.P. de Fermat Senatoris Tolosani*"), that the Theorem became known. It was well placed (at least sequentially), because it featured as *Observation 2*.

This most insolent of mathematical "theorems" (particularly provocative because it concerns the integers, apparently the clearest, most natural of objects, and which seemingly belong to the intellectual faculties of all people, in the same way as language: everyone is capable of counting), which remained unproved for three and a half centuries (supposing that it has indeed finally been proved, as everyone supposes, for as I write these lines, Andrew Wiles's proof has been examined in detail by his own eyes only, and so it has not yet been truly "certified"), was thus "jotted down" explicitly for the first time in the margin of the margin of a translation from the Greek, as the addition to a codicil to a glossed transcription of the testament of ancient arithmetic (one of those additions that Fermat described, with his usual ambiguously modest pride: "*perhaps posterity will be grateful to me for having shown that the Ancients did not know everything*").

The same narrowness of margin that precluded his revelation was also mentioned by Fermat in another commentary, *Observation 45*, though this remark was at least developed to the extent that we can be sure Fermat did in fact "possess" a proof (even if

it wasn't a very rigorous one) of his theorem as far as the "squares squared" went—in other words, the fourth powers (and probably too for the cubes, which are a particular case in the general theorem, with which Fermat began his presentation ("it is impossible to separate a cube into two cubes"), and which he mentioned in several letters as early as 1636): *"Demonstrationem integram et fusius explicatam inserere marginis vetat ipsius exiguitas."*

Everyone thinks (today unanimously) that they're also fairly certain about the "idea" behind the proof that Fermat had in mind: the method he had invented and called "infinite descent." He applied it on several occasions, calling it "subtle and ingenious," and all of the allusions to particular cases (the numbers 3 and 4) of his "Last Theorem" refer to it indirectly. The point is, for each circumstance of its application, to show that if a given property were true for any given integers, then it would also be true for numbers that are strictly smaller, and thus cannot be true for either of the former or the latter; for example, if the cube of a number  $z$  was the sum of the cube of a number  $x$  and the cube of another number  $y$ , there would be three numbers,  $x'$ ,  $y'$ , and  $z'$ ,  $x'$  being strictly smaller than  $x$ ,  $y'$  strictly smaller than  $y$ , and  $z'$  than  $z$ , such that the cube of  $z'$  would be in turn the sum of the cube of  $x'$  and of the cube of  $y'$ . Hence, the result would be, if the same reasoning were used on the hypothetical triplet,  $x'$ ,  $y'$ , and  $z'$ , that there would be a new triplet,  $x''$ ,  $y''$ , and  $z''$  (being "smaller" still) which would have the same property. But it would be impossible to continue indefinitely, without arriving at zero for all the quantities (as Fermat put it (in Latin): *"taken a given integer, there cannot be an infinite number of integers smaller than it"*).

Now, this method of “infinite descent” does indeed succeed, without too many problems, in proving the theorem for cubes and fourth powers, but there is a “quantum leap” of difficulty if it is used, as Legendre tried to do at the beginning of the nineteenth century, for  $n = 5$ , and it stops being of any practical use once  $n$  reaches 23. Thus, the general conclusion is that Fermat had a more or less detailed sketch of a proof for the first two “cases,” and thought that it would remain valid for the others. Infinite descent was too “marvelous” not to provide the key to this result, as it had done for so many others. It should be added that, if it is true that Fermat almost never announced number properties that later turned out to be false, he nevertheless did so on one occasion; and so we end by saying, with a touch of condescension, that there is absolutely nothing dishonorable in this. Posterity, now better armed, will rectify the situation.

**95 I used to know one mathematician who did not agree with this.**

I used to know one mathematician, at least, who did not agree with this. I can clearly remember a moment, during a dinner, which I can't situate in time or space (not only are its “spatio-temporal coordinates” lacking—even approximate ones—as sometimes happens but without raising any real doubts about them, and not only do they fail to surround this moment with an aura of certainty even after a slight hesitation, as often happens too, and not only am I incapable of placing it in a Minkowskian space that resembles the outside world, but it remains absolutely detached from everything else, despite all my frantic efforts,

all the more frantic because a “dinner” (being at a real dinner, a dinner with a white tablecloth and silver service, a large number of guests situated around the table, and conversation limited to those immediately around you, the sort of dinner that this was (I remember that)) is quite a rare event in my life, and this should have made it easier for my memory to identify);

at a given moment during this dinner, then, I heard someone express this paradoxical opinion (paradoxical for anyone aware of the unanimous view of mathematicians on this point), that Fermat could well have had an “elementary” proof of his theorem, using his method of infinite descent (but that the mention of “infinite descent” is not, in itself, enough to evoke the idea of a proof) seasoned with an ingredient that was so “subtle and ingenious” that it has escaped his successors’ attention. Then he wrote down a few explanatory formulae with his pen on his napkin (which was not a paper serviette). This is the moment that I can’t situate in the past, and yet, quite distinctly, can **see**.

The person who expressed this paradoxical, surprising, and almost shocking opinion (illustrated in a way that was not paradoxical but certainly surprising and shocking for the lady of the house (unless she was already blessed with experience of mathematicians in general and of this one in particular, in which case the way he grabbed his white napkin (which was not made of paper), produced a pen, and then started to cover the cloth with ink would already have ceased (while remaining perhaps shocking) to appear surprising)) was an algebraist named Marc Krasner.

(When I was a student, he belonged to the generation of the “masters” of new mathematics, and part of my mnemonic per-

plexity lies in the fact that there is no possible reason why I should have been in his company at some dinner or other at that same time; hence my conclusion that this moment must have occurred much later; this conclusion is also backed up by the fact that I would not really have been able to follow his reasoning or its unusual character back when I was just starting to study algebra; thus the scene must have taken place during the years when, already more advanced, I had the opportunity to listen to him or meet him at this algebra seminar at the IHP; I can still picture the room and can see him there, quite distinctly; his appearance was extremely striking.)

He was what used to be called an “old bachelor boy,” seriously negligent about his clothing, portly, with a heavy build and features, but whose roundness was decidedly soft and somnolent. He spoke slowly, with a (Russian?) accent, without seeming to recognize you as belonging to the race of people who communicated in the language of mathematics, and perhaps without even seeing you at all. He worked on the theory of Galois (which is all I’ll say on the matter, I didn’t know him—as they put it in what I find to be rather an absurd way—“personally”).

His absentmindedness was legendary; or perhaps I should say, his passion for somnolence (which seemed to be his true vocation) led him into incredible absentmindedness. People spoke of it with a certain pride, as though it added to the exceptional quality and indefinable flavor of mathematics itself, since certain members of the tribe of his worshippers seemed to adore his extraordinary eccentricities. To take a typical example: Krasner, as I may have said already, attended (?) or participated in (?) (both

verbs are inadequate, as we shall see) the algebra and number-theory seminar (also called the Dubreil-Delange-Pisot seminar), which took place on the street level of the IHP, in the first room to the left along the corridor. (I can remember this so clearly that I would be sad if I discovered that these memories were false.)

He always arrived at the seminar late. Advancing noisily and heavily between the participants, while the author of that day's presentation paused politely to give him time to find a seat, he headed toward the place that had been left empty for him in the front row, peered at what had been written on the board (walking over to the black surface, which was stained and lined with chalk), sat down, fell asleep, and snored. Such was the almost immutable ritual of his "participation" or "attendance."

Then, one day, when the door opened as usual, a good fifteen minutes after the beginning of the seminar, Krasner came in, walked over, sat down, and as tradition demanded prepared for a nice snooze to the gentle hum of algebra (which still managed to enter his brain, even as he slept, because he would occasionally wake up to ask a question, which was more or less appropriate to the immediate context (of what the lecturer was saying) depending on the greater or lesser delay in his dream world's transmission time). It then became necessary to inform him respectfully that he was supposed be delivering the lecture that day.

He had a great interest in Fermat's theorem (I don't know if he'd ever dreamed of proving it). This had taken him in a particular and rather perverse direction. I learned (during the dinner in question) that he had made it his hobby (though at a modest fee) to formulate replies to the amateurs who regularly inundated



the Academy of Sciences with solutions to this legendary problem (having been deprived of squaring circles and trisecting angles thanks to the progress of mathematics, amateurs had (and do still, if I can judge by the person who, thanks to the announcement of Wiles's proof, just succeeded in getting himself onto television) all fallen back on "Fermat"). He read them and indicated their errors (→ chap. 4). (Some gave up; others persisted, revising their "solutions," before submitting them again and being refuted once more. I remember Chauvelon, my old teacher at Lycée Henri-IV, who used to correct and correct again the Latin translations and French essays we wrote for homework, which he called our "little tasks," and which we had to revise again and again until they reached perfection. But the "little tasks" of the Fermat amateurs, as corrected by Krasner, never made it that far (→ branch two, § 49).)

## **96 The deep-seated conviction that Fermat could not have had a proof of his theorem**

The deep-seated, widely shared conviction that Fermat could not have had a proof of his theorem comes from the long history of attempts to establish one. Mathematicians explain how, toward the middle of the nineteenth century, there was a revolution in the way the problem was approached, using new methods about which Fermat could have had no idea. This bifurcation (which was decisive, if the objective has now been reached) occurred thanks to the work of the German Kummer, who "imported" what we now call complex numbers (after first calling them imaginary ones) into an affair that previously seemed to concern only integers, while at the

same time “inventing” an essential tool in “modern” algebra: the theory of “ideal” algebraic numbers.

While commenting on his theory, Kummer felt the need to reach for a metaphor, so as to help the mathematicians of his time to absorb ideas that were clearly quite new. He thus turned to the world of chemistry (which, at the time, was still far from “bifurcating” decisively towards atomic theory).

*“The composition of CN (complex numbers) can be seen as analogous to a chemical composition, with prime factors corresponding to the elements. Ideal CN (his invention, whose relevance he is here trying to justify) are comparable to the hypothetical radicals, which do not exist by themselves, but only in combinations; fluorine, in particular, being an element that we cannot represent in isolation, could be compared to an ideal prime factor.”*

Fluorine, as everyone knows, has since been “isolated” (by a playmate of Alphonse Allais), and we are all convinced of the “existence” of this element, which is no longer just “ideal.” The same goes for Kummer’s “ideal prime factors” (though the terminology has varied slightly, and without dwelling on the “degree of reality” that can be allotted to mathematical objects; for today’s mathematicians, in any case, their existence has been as solidly established as that of fluorine).

Kummer went on, spinning out his metaphor:

*“The notion of the equivalence of ideal numbers is basically the same as that of chemical equivalence; just as quantities of weight can be substituted one for the other so as to make salts neutral or bodies isomorphic, in the same way ideal numbers, replaced by equivalent factors, do not produce ideal numbers of the same class.”*

*“Finally, as chemical reagents, mixed with a dissolving body, produce precipitates which can be used to identify the elements contained in the body in question, in the same way, the numbers we have here designated as  $\psi(\eta)$ , as reagents on CN, reveal the prime factors contained in the CN, by displaying a prime factor  $q$ , which is analogous to a chemical precipitate.”*

Also attributed to Kummer is a slighting remark about Fermat's theorem, which, he supposedly said, was a “joke.” A certain, constantly resurgent ambiguity toward their discipline, felt by all mathematicians, can be seen in this piece of provocation. And while we can be sure that—to his credit—Kummer considered his concept of “ideals” (whose eminent place in the development of algebra has been effectively recognized) far more important than having, with the help of this theoretical construct, obtained a proof for Fermat's theorem in a large number of its cases, it was this very result (however secondary it might have seemed to Kummer himself (and we should at once discard the hypothesis, long defended but now discredited, that this reaction was of the “sour grapes” variety: Kummer is supposed to have thought that he had proved the theorem completely, without noticing at first that his proof could not be applied universally and contained exceptions; the numbers 37, 59, and 67, among others (but alone among the first hundred), slipped through the net of his “ideals”)) that demonstrated without any possible doubt the value of his idea.

Whatever the truth of the matter, the path taken by Kummer suddenly (and permanently, it would seem) removed the “Last Theorem” from the strict domain of elementary arithmetic, to which it used to belong because of the simplicity of its presenta-

tion. The mysterious “prime factor  $q$ ,” the “chemical precipitate” of Kummer’s theory, brought to light by those “reagents” which are the no less mysterious ideal complex numbers, provide a glimpse of a world “behind” the apparently limpid surface of whole numbers and their arithmetical properties, peopled by far less accessible, obscure numerical beings, whose strange laws it was necessary to understand before being able to apprehend the integers and obtain answers to questions such as Fermat’s, which otherwise might have remained unsolved forever.

But, at the same time, it now became impossible for minds like Fermat’s, possessing only a knowledge of elementary arithmetic, to understand this sort of reasoning. (To show this “comprehension gap,” it is sufficient to compare Fermat’s presentation of his great theorem with Kummer’s of his main theorem: “The equation  $x^n + y^n = z^n$  is insoluble in integers for all odd prime exponents  $n$  that do not figure as factors in the numerators of the first Bernoulli numbers  $(n-3)/2$ ” . . . and I shall say nothing about the proof.)

## **97 After sharing my emotion over the phone with everyone I had succeeded in reaching**

After sharing my emotion over the phone with everyone I had succeeded in reaching (some of whom at once passed on word in turn; for example, Paul Braffort called up Michèle Ignazi at her bookshop (she was perhaps less affected by the news itself than by the juvenile enthusiasm shown by Paul (of the Oulipo) that day (as she told me). He thought (we thought (both of us, indepen-

dently)): “Ah! If only Queneau had seen this day! Ah! If only François (Le Lionnais, founder/president of the Oulipo (→ Bif. A)) had seen this day!)), I retreated into myself to savor it (even “retired from mathematics” as I am today, I’ve kept one of the characteristics of the species (or tribe, or family) (at least, in my generation), which is a delight in the announcement of beautiful results, almost as if you had taken part in the discovery yourself: “Have you heard? So and so  $A$  has proved such and such!” “Impossible! Are you sure?” “Yes, so and so  $B$  told me, he heard it during  $W$ ’s algebra seminar . . .” “Goodness me!” Then we smile and congratulate one another, knowing fine well that neither of us had anything to do with it).

I had another, quite personal reason for satisfaction. It had been known for a while that a proof was “in the air.” A great step forward had been made by the German mathematician Faltings in 1983, when he showed that if ever there were solutions to the fatal equation for a given  $n$ , there could be only a finite number of them. There had also been a Japanese false alarm . . . Mathematicians all round the world and from many nations were “on the case.” But Andrew Wiles was English, and the announcement had been made in Cambridge (England). As an Anglophile, I liked this additional point.

I immediately made a provisional decision, which I shall discuss during the next moment. I then saw, once my exaltation and euphoria had subsided somewhat, that a certain sadness had surreptitiously mingled with my joy: so, the Last Theorem had been proved, what a triumph for mathematics and, as old André Weil might well be paraphrased: “what glory and what an honor for the

human spirit!" Of course! And yet. And yet, Fermat's Last Theorem now no longer needed proving! This is what cast a shadow over my jubilation. While I did find rather absurd the big, black, bold, metaphorical headline in *The Guardian*, "**THE FINAL FRONTIER**" (the territory of mathematics is not the America of old Westerns; pioneers will never reach the Pacific Ocean of established knowledge, after massacring the Indian tribes of ignorance; the "frontier," if such a thing exists, keeps receding; there will be no end to mathematical history, just as we aren't witnessing the "end of history" itself, as announced by Mr. Fukuyama, of the American Hegelian Right, in the euphoria following the fall of the Berlin Wall);

it was, nevertheless, the oldest unproven result, and this impressive obstacle had inspired countless efforts and vocations over the centuries, so that the disappearance of this "terra incognita" made me feel a twinge of regret (I sensed that many must have been feeling the same way).

(Without mentioning the fact that, once the excitement of the news (which was going, that very afternoon, to hit the front page of *Le Monde* (and be talked about on TV)) had died down, we would be robbed of an easy subject of conversation with non-mathematicians: how many times, during a life in mathematics, had the occasion arisen to tell laymen about the legend of the Last Theorem! We said: "See, there's this theorem (whose presentation is easy to understand; everyone remembers more or less accurately the "Pythagoras's theorem" of their childhood, and, once that much has been recalled, plus the fact that  $16 + 9 = 25$ , it's simple enough to make Fermat's comprehensible); and it's very difficult." "Really?" Yes, really; as a matter of fact, it was written out in about 1650, and we still can't prove it." "Incredible!")



So what can we say now? That it's been proved? "Of course it has, that's your job, isn't it? As mathematicians." "Yes, but it took us three and a half centuries to get there." "Just for that?" "Yes, just for that!" "Well, don't expect me to congratulate you!" It used to be a mystery! Something inexplicable!)

(I must admit that such regrets are not on a particularly high intellectual level.)

When he called me the next morning, Jean Bénabou, who had also read the article in *The Guardian* thanks to our phone messages, also spoke of his joy followed by a certain sadness; then he added that there was something intellectually infuriating about the fact that in order to prove a theorem, whose presentation was so elementary, it had been necessary to use such an impressive quantity of results drawn from all sorts of mathematical regions, with the sustained, concerted efforts of the entire worldwide community of mathematicians (who had other aims in mind of course, even though "Fermat" remained in their sights). He said: "It's as if Everest had been conquered using NASA rockets."

In his excellent paper, published in 1921, *Three Lectures on Fermat's Last Theorem*, the English mathematician L. J. Mordell (whose "conjectures" defined certain important steps that needed to be taken while scaling "Fermat mountain") used the same climbing comparison, though in rather a different way: "***Mathematical study and research are very suggestive of mountaineering. Whymper made seven efforts before he climbed the Matterhorn in the 1860s and even then it cost the lives of four of his party. Now, however, any tourist can be hauled up for a small cost, and perhaps does not appreciate the difficulty of the original ascent. So in mathematics, it may be found hard to realize***

*the great initial difficulty of making a little step which now seems so natural and obvious. . . .”*

It is certainly true that once Wiles’s proof has been confirmed (it now finally has been, it seems, after some delay (note added in 1995)) and assimilated by the specialists, it will gradually be reduced, simplified, signposted and, in a few years’ time, will probably be accessible to far more people than it is today. However, the “gap” in comprehensibility, created by Kummer’s discovery in the mid-nineteenth century, can’t really be reduced. If it is really necessary to use such varied and elaborate theories, as appears to be the case, the threshold of intelligibility will be even higher than for Kummer’s results, which good students in “prep classes” are now able to handle.

Jean Bénabou’s remark also touched on this question: should such an “elementary” problem really require in its proof the use of methods that seem so distant from arithmetic, and in particular those which are (so significantly) termed “transcendent”? Should this fact appear natural, sublime, inevitable, or scandalous? Should we now look for a different, “elementary” proof (which doesn’t necessarily mean “easy”)? Is this feasible, pointless, or impossible? I shall make no pronouncements on such questions.

## **98 However, I did make a provisional decision**

However, I did make a provisional decision: I would try to understand Fermat’s theorem. (I have added the restrictive adjective “provisional” to my decision, because I know myself; I easily make programmatic decisions, preferably long-term ones, and preferably requiring long, hard effort; I hardly need to add that I rarely

stick to them.) I thus formed the project of understanding; but in what sense?

It was perfectly pointless, at my age and with my rather rusty knowledge of mathematics, to try and master the proof of the theorem from the start, even with the aid of the few simplifications that the coming years would bring. I had to fix for myself a limited horizon of comprehension.

I told myself that all I wanted to do was grasp the articulation of the ideas, and follow the development of thought about the theorem, from its prehistory (before Fermat) up to its resolution.

(I should add to this a secondary proposition: to watch—from the corner of my eye, so to speak—the rebirth of the idea of “infinite descent,” given that Yvon Gautier has recently suggested using it in his enterprise to rebuild logic, based on a “Fermatian arithmetic,” in which its job will be to replace so-called “complete” induction.)

At the time of this writing, I can just about grasp the state of play as Mordell presented it in his lectures of 1921: there’s nothing insurmountable in all that for my powers of understanding. But afterward?

I realized that if I wanted to continue, the most reasonable solution would be to find a guide, someone who could tell me what to read so that I would avoid getting lost heading down dispiriting dead ends. But it was also true that getting lost wouldn’t really matter very much, because this work would have no aim other than itself, no external reward or sanction. The inquiry itself, the very quest would suffice.

Being retired from mathematics (although I have not retired *period*), I could give some of my time to this new project of understanding.

When setting out, in early 1962, on the path to entering (even modestly and late in life (I was almost thirty)) the mathematical community (by researching and completing a thesis, followed by a slow but steady progression up the hierarchy of university posts), I had, without really admitting it to myself, actually abandoned my initial intention, which had been both vague and excessive, though it had (as I have reconstituted it from memories in the first two chapters of this branch) supported me through my intense reading of Bourbaki's Treatise, and as far as 1960 or 1961: to understand Mathematics.

So why not readopt my old intention, in a manner both more limited and more precise? Why not, indeed? But this latest decision was also absolutely arbitrary. In which case, why include it here, in this narrative? Because it in fact results from a necessity intrinsic to what, to my great surprise, I am not abandoning but instead stubbornly continuing, this “**great fire of London**” whose third branch you are reading. The entirely contingent announcement of the proof of the Last Theorem merely provided this necessity with some explicit content.

(Of course, I know perfectly well, at the very moment I am writing this, that I shall not go through with my intention, any more than I have with countless others, any more than I succeeded in completing my **Project**. I know that I shall die, quite probably, “Fermat”-foolish; or almost.)

## Chapter 4

### Zero Point

#### **99 August is beginning and it is hot**

August, the month of climatic excesses, is beginning. And, as at the end of July in Paris, it is hot. An obstinate, creeping, limp heat, windless and saturated with car exhaust. The variations on suffocation caused by an overdose of ozone (which doesn't fly away through the hole over Antarctica!) waver between "borderline" and "very borderline" (with the occasional peak toward the danger zone). The streets, apart from the symbolic avenues given over to the cameras of the Japanese (the foremost contemporary disciples of Niépce, Daguerre, and Fox Talbot), display their empty sidewalks beneath the dense air. After nine in the morning, I live behind closed shutters, and open them again only at night, to let in some purely imaginary fresh air. This is just a foolish imitation of Mediterranean customs, which I took up on coming back from Romania (and the same thing applies a year later, day for day, on coming back from London as I reread this chapter and fine-tune its lines, left inert at that time; I add a little, as little as possible, so as not to bend the rules I've given myself too much, simply marking my additions with a different font size on my screen); a reflex gesture, no doubt inscribed in me genetically (though I don't shake my sheets out the window). It is quite patently ineffective. Not the slightest breath of a night breeze in the early hours refreshes my limbs leaden from bad sleep.

With the shutters open or closed, my solitary room at once adopts the outside temperature as soon as the sun makes its indirect appearance on the facing wall of the courtyard, and it then retains it until very late in the night, with an unvarying tenacity, reluctantly dropping two or three degrees at about four or five A.M. At that time, perhaps, I could sleep properly. But it is then that, faithful to a lifelong compulsion, I wake up. I haven't taken my homage to Provence so far as to place an earthenware water jug on one of my two narrow windowsills. I have a fridge, lodged like a cupboard beneath the hot plate in what serves as my kitchen. Now over a quarter of a century old, it's giving clear signs of fatigue from the efforts it has to make during this heat wave. During my absence (before which I'd forgotten to make it undergo the process known as "defrosting," which is essential to its physical health (and increasingly so the older it gets)), it has acquired a sort of snowy mantle of ice that, I've just realized, has started to melt drop by drop onto my cartons of (ewes' milk) yoghurt on its bottom shelf. I should turn up the dial that sets the temperature inside by at least one notch, as it's been at level 2 since last December; but this is impossible, because an icy hernia is preventing any movement. Of course, what I should absolutely do is rid my faithful servant's motorized heart of this refrigerated cholesterol; to do so, however, I would have to stop it long enough for its tumor of ice to melt (at least for an entire night), but this simple operation is now out of the question for the same reason as I indicated above: I cannot turn the dial. The sole solution would be to cut the electricity; but if I do so during the night, I will deprive myself not only of cold drinks (Diet Coke (of the severe (caffeine-free) sort),



or Badoit with aniseed syrup (which stands in for “pastis”: *always Provence!*)) but also of light (night is never really dark in Paris, but all the same!); and if I do so during the day, I will paralyze my Macintosh LC for the same period of time and will have to use my “laptop” (a PowerBook “duo”), having first fully recharged its battery. In fact, I do nothing of the sort (I hadn’t even thought of such a solution before writing it); I will quite simply wait for my next trip away from home to solve the problem. I just hope that my fridge will last that long without having a stroke. Talk about living dangerously. I could, in reality, spend an entire day without my computer, given the deep intellectual sluggishness this heat has thrown me into. (The fact of my writing these lines seems in part to contradict what I’ve just said. Yes, I was able, at least, to do this much; but that proves nothing about the general state of my brain. (It’s just that yesterday, on the sixth of this month, in the middle of summer, a certain lessening in the heat made itself felt, while the forecasts have announced thunderstorms, and I’ve started to believe them.)) It is only in this way, through a debilitating heat wave, that Paris manages to force itself into my life, impose its presence upon me and triumph over the absolute indifference that I maintain against it at all times.

I have never liked Paris. I have never completely overcome the gut-level hostility and utter rejection that I felt when I arrived here to stay for the first time, to live, during the winter of 1944–45, fifty years ago now. Paris was just a land of exile, where the childhood freedom I had experienced during the years of the Second World War, or *the war*, for my generation, was lost: no more olive trees, almonds, thyme, vines, roof tiles, gables, squirrels, brambles, or

scrublands; walking barefoot in the street was now out of the question; no more garden, no more space. Paris was an enemy city. Over time, when it became clear that it would be impossible to turn back, and especially when even the idea of contemplating such a return was, without warning, out of the question, I little by little replaced my spontaneous hostility with indifference (I've added to this, though indirectly, as though by refraction, thanks to Queneau's *Pounding the Pavements* for example, a certain curiosity, rather cold, sometimes amused, sometimes malevolent, which is not necessarily harmful to the practice of poetry); above all, I have slowly but surely sorted out the routine of my existence so as to live here as though I were not living here.

Of course, from time to time, and even quite often, I imagine myself being otherwise, actually living elsewhere. And this elsewhere is, almost always, England; or rather the United Kingdom: London most often; Scotland and its islands sometimes (setting up on one when I retire, which will be soon now). But I've never done the slightest thing to make such an elsewhere possible. "Why realize your dreams? They're so beautiful," as Villiers de L'Isle-Adam said (→ § 18: I love the dandyish pessimism of this question). But there are still cursed weeks of intense heat during which I can't stop Paris from making its presence felt. I almost never suffer from its filthy rain, its lousy winters, or even from its spring days, which are supposed to be delightful and lively, or its falls of russet chestnuts. I laugh at its attempts at seduction just as I do its sulky weather conditions. I do not worship its cafés or its expressways. I do not gaze at Notre Dame or the Pantheon, that other "gem of Gothic art." I close my windows; I am at home; I forget about it all.

But there's nothing I can do about its fits of hysterical, overheated weather. Paris is no good at being hot. It (or she) avenges itself (or herself) on me, by disturbing the pre-morning hours that are mine by right. It tries to stop me benefiting from its sole saving grace: the emptiness of its streets in August, telephone silence, its august state of almost all activity being suspended.

Yet, year in year out, I stay in Paris in August, obstinately. After all, I say to myself, full of hope, in the past half century there have been wonderful, efficient, even chilly Augusts; I am constantly praying in vain that the summer will be "dreadful." What's more, these Parisian heat waves that outrage, offend, and revolt me have a particular tendency to remain fixed in my memory (a memory of dog days and nights for me personally, even if the weather records don't confirm this numerically (apparently, the month of July this year (1995) was less hot than last year, and far below the record; and I read that in England it's been awarded a measly bronze medal for the century)), and summon one another up so easily that they've now developed a sort of causal relationship between themselves (an order which is, illogically, not necessarily chronological in my mind). By extension (by resemblance or contrast) I can, in the uncomfortable insomnia of one of those midnights of sticky pillows, envisage exploring in the light of memory all of the states of great heat (or of lesser heat? of great cold?) that I've experienced in Paris, or elsewhere: New York in 1963, for example; 1976 beside the Mississippi (in fact the weather was less ferociously hot than in Europe, which that year broke "historic" records, if memory serves). (In August 1952, the night burned darkly on Avenue Gabriel, during my last, harsh, hard, and irreversibly final encounter

with L. I was to see her only once more, in 1976 as it happens, in Saint Louis, Missouri (an hour in a museum, of all places!; and I had undertaken that entire journey—I won't say *just* to see her, but after all, she had written to me. And when I saw her, when she saw me, it was exactly like in that Alphonse Allais story: it wasn't him at all, it wasn't her at all! For it was no more).)

But this is not part of my story, as I have conceived it, as I am endeavoring to tell it. However, it is true that the heat of 1952 remains precisely adjacent to the heat of today, and it's difficult to separate those two images. They are part of a sort of universal, continual August. Each image of each necessary moment of the past—necessary to the reporting of my adventures in memory—is constantly being covered over by another image, most often lacking any “semantic” points of comparison with their points of departure (at least not in terms of the “sense” I have imposed on my narrative); each neighborhood of each past point adheres to the neighborhood of each of the others; as if the topology of the memory were inevitably lacking in “separation axioms” (→ chap. 3).

The attentive reader (who knows better than I do the events that have marked this century) will not fail to recall that on August 6th, 1945, the first atomic bomb was dropped on Hiroshima. (I look at a page of *The Times* of August 6th, 1995, which shows the reddened face of an eighty-year-old Japanese man, one of the few survivors of the massacre; having escaped from the fire of the “thousand suns,” he decided to flee from this cursed city, and took refuge in Nagasaki; he didn't die there either; this exceptional “double” has now drawn the attention of the global media village; he's almost a “super model,” in fact, but his eyes show no sign of any narcissistic satisfaction.) That conflu-

gration, that terrible illumination, is not being recalled to public attention just because of the commemoration of its terrible fiftieth anniversary, but also because the French state—via the voice of its freshly elected president—has made a spectacle of itself by announcing a new series of tests of a “French” bomb on Moruroa Atoll. This too violently rekindles my memories. I needed this threefold trigger, this triple convergence (intense heat, calm due to this intense heat, and the reddened face in a newspaper of a twofold miraculous escape from atomic death) to help me overcome a sort of paralysis that struck me when thinking back over 1960 and 1961, and which immobilized me for almost a year right in the middle of writing these pages, though those three triggers have no substantial point in common with the event I am avoiding (I saw nothing of Hiroshima), apart from one major historical coincidence. Though insignificant when compared to this world event, but at the same decisive when it comes to the sort of point-by-point reconstruction that I’m laboring over, a fact about my own past, deeply engraved in my memory, is connected coincidentally but inseparably to another experience of great heat, and to another atomic explosion. I can’t go back to it, or think of it from and according to its future, about the meaning I should give it here, without letting the images that accompany it break in at the same time. In themselves, they don’t frighten me at all. If I needed so long to overcome a sort of inner taboo about bringing them to light, this is doubtlessly due (the sole explanation that I’ve been able to find) to their proximity, their relationship of contiguity (which I felt without any logical causal relationship) to other images, which come from farther back in the past, while remaining quite close chronologically: those visions, which I am



not yet capable of expressing, are the real “taboo” (thus, not at all an unconscious one) weighing down on my ability to *tell*, because I refuse to let them take control of my mind, and they all behave like some vindictive being, acting as though they shared a form of solidarity: “If you can’t say this, then you won’t say that either!”

Sure enough, I am experiencing the greatest difficulty in placing even one mental toe into the orange sand awaiting me, so to speak, on the other side of this line of silence. Morning after morning, I remain mute, in fact. Sometimes, I can’t even switch on my Macintosh. Sometimes, I sit in front of the screen for one or two hours, having stopped at the same point, letting its gleam go off ten or twenty times and be replaced by the ironically animated clock of its screensaver. Sometimes, I go so far as to write a few tortured, inadequate sentences, which I leave, not to be erased, because their existence is merely virtual, but simply not to be preserved, not to be “saved.” And so on.

What will happen now? Either the difficulty will suddenly stop being insurmountable. Or, like so many times before, after many days, and many seasons, I will still not have succeeded in taking the necessary step forward in my narrative, and like so many times before, I shall change directions (I’m always changing anyway, even when there’s no sign of any difficulty, or even of any idea of difficulty (which could still exist underneath; the aim of many digressive techniques is to avoid invisible traps and obscure dangers)). I shall turn off toward a different path to be cut through the forest of past events (while always keeping the hope of returning). Such (frequent) struggles do not leave visible signs in the regularly divided succession of finished moments that I offer to



the reader. For everything that appears as such has won the right to last, by securing its electronic position (subsequently converted into a different, material form on paper). But this time, I have decided to adopt a different strategy, so as to force a decision. I am writing this, I am writing down what is happening, my extreme difficulty to speak, and the form this takes; and I am not allowing it to disappear. The rigid axioms that govern me thus determine that these very lines must be part of what will have been written. I cannot rid myself of them. If I go beyond the point of obstruction, so much the better. These lines will then simply mark out the existence of such an obstacle, and the fact that I overcame it. And if I do not? If not, then it will all come down to the same thing: the fact that this obstacle was there, and that I did not (or have not yet) overcome it. But I shall at least have said as much.

**100 The “second-class club facilities” on the “base” were in a corrugated iron shack**

The “second-class club facilities” on the “base” were in a huge, rectangular, corrugated iron shack, placed directly on the sand, without any floor. During the long lunch break, and in particular later, after five o'clock and until curfew (and, it seems to me, even late into the night (which always comes early at this latitude) thanks to some kindly tolerance or laxity on the part of the military authorities), it filled up with draftees wearing their gear, uniforms variously more or less up to regimental standard, attracted by a ferocious desire for liquid, as well as by just as strong a desire for human or even draftee company. Its sole entrance was in the

middle of one of its long vertical sides. The building's topography could not have been simpler. The rectangular floor was oriented (from the perspective of its habitués) in the direction of the section of greater dimension: this part being the "front," the other the "rear." The former section lay to the left of the door, facing the long plank of the "bar"; to the right was the rear, behind a plywood partition, full of crates of drink.

There was a choice between just two types of liquid: either beer, in glass bottles without any indication of their contents or brand, it seems to me (I can't picture any); or soda, but only "Verigoud" tangerine (like the ones I would drink a year later in Algiers), I think. (Here, I have said "it seems to me," then "I think," although I could say as much for each sentence, each memory, or nearly. This is the way I remember it; I should add: from one memory to another, I establish explanatory gangways, which provide an overall coherence; my explanations are perhaps total "fantasy," even if I try to remain as close as I can to what seems true, or possible, or real; but what can I do about it? How can I make certain? And why bother? (→ § 23)). "Second-class soldiers" (as I was) were served at the bar by other "second-class" men from the "contingent" who had been appointed to the "facilities" (a highly desirable "cushy billet") ("contingent" was meant to indicate, I think, that the members of this group were only included therein because of the coincidence of their years of birth, thus making them the "59-2," the "60-1," etc., and quite independently of their will).

Very occasionally, a "noncom" could be seen there, but never an officer; not even one of those "curious specimens" in the military zoo who are "career corporals," complete with kepis (a second-

class professional soldier, like “Soldier Brû” in Queneau’s *The Sunday of Life*, but for my part I never met any). People collected their beers, or their sodas, then went to sit down somewhere on the sand. A group could even take away a complete case to be shared out. The first beers, or first sodas, from the first crates were cold. But nothing in that air, on that raft in an ocean of sand, stayed cold for very long. The last beers were warm, to say the least, before the arrival of a new crate from the “rear” of the bar. And even cold beers, when held in the hand, warmed up incredibly quickly. So the first ones were fought over.

But it was the newcomers, those who had just arrived at the base, the “rookies,” who were most drawn by the ephemeral coolness of those drinks. They dived onto them, argued over them childishly, like boy scouts, or teenagers at a holiday camp. Once they had their drinks, they drank them, very quickly. But the chillness evaporated at once in their throats, leaving their thirst intact. So they had to have more immediately. But the second beers were already warm in their crates and in their hands. It seemed to me that never would the “law of diminishing returns” be so vividly confirmed.

Thus, the “veterans,” who had been there for at least a hundred days, counted one by one, or still more, or those who had stopped counting, or not yet started again (the count began again when the last day approached, the count for the “return to the continent” or, even better, the day of having “leave in hand,” or being “demobbed”), no longer bothered with bustling around the newly opened crates; they were indifferent to the temperature of the liquid, and chary with their movements; they always sat in more or

less the same places (tacitly reserved for them, in preference not too far from the bar, back against the partition), their hair, eyebrows, caps, fatigues, pants, shirts, boots, and faces all uniformly of the same middling color, between (orangey) sand, pale beer, and (orange) soda, and remained there for hours, barely moving, barely speaking, slowly drinking one, two, three, ten bottles according to the state of their moods and finances, then standing up suddenly, one by one, or in twos, or threes, in a group, and setting off more or less steadily toward their respective sleeping bags, or their guard posts, into the night that had become cold, harsh, brutal, beneath the incredibly distinct, close, irritating, mocking stars.

According to my calculations, at least ten crates of beer were consumed for every crate of soda. This proportion may seem surprising, at first glance. Warm beer seems to me (I never drank any) to be far more unattractive than a soda of the same temperature, but I have to admit that it does have other virtues: its low alcohol content ends up acting as a chemical bludgeon, wiping out all thought for a long and happy moment, as well as any loneliness, indignation, or despair. It is, as Pierre Lusson would have put it, "slightly euphoric." One doesn't become really drunk; or rather one is already more or less drunk from the first sip, because of the unspeakable, immense heat; one simply becomes more incoherent, more uncoordinated, sinking into the sand, dumb, stupefied. As the evening wore on, the more half-empty bottles lay spilt, and the more crates were broken open, the more that beery, dull, bitter odor, both parching and nauseating at once, could be smelled as you went inside.

There was almost always a crowd in the club, but this crowd wasn't very lively, slow in its movements, dull and hesitant, like resigned long-term patients in the courtyard of a hospital, or a home for old soldiers in nineteenth-century France. Eloquence, laughter, absurd jokes, discussions, outbursts, enthusiasms, boasts, and arguments were rare; except, occasionally, late in the night, after closing time, according to whispers and rumors the next morning; there was talk of insults, punches, knives. I never witnessed the slightest dangerous or even disorderly eruption of fury. Though it's also true that I always went there quite early and didn't stay very long. The reigning tone was a vague murmuring, a ground bass of dull voices, the *Sprechgesang* of resignation. (I shall not mention the atypical "days of wrath" that roused base during the "Generals' Putsch.")

Here and there, "transistors" were stuck against ears, as the sentimental listened to the hit songs of the day, the music of their village or their suburban dances ("*I've a pretty girl and I'm in love with her / but here comes the snag / she wakes up at night / and says make me couscous darling / make me some couscous!*" (Daniel Moreno?)—or else (Bourvil) "*The first name your father gave you / was fruit salad, ah what a lovely name . . . Fruit salad lovely, lovely / your father loves you, your mother loves you too / fruit salad lovely, lovely / we must get married one of these days . . .*"). But most shunned such deceptive consolations.

I too would sit down for a while every evening in the sand, with my soda; and every evening I would stare ahead of me at a scene whose monumental incongruity gave the entire place a sort of allegorical, cruel, or derisory perfection: for, behind the bar, a pho-

tograph that had been carefully blown up to the largest possible size occupied the whole wall. Thanks to some military bureaucrat's philanthropic or behaviorist good intentions—or else his unintentional sadism or even offbeat sense of humor—the chosen scene depicted a woodland in the full bloom of springtime. The image was saturated with the youngest, brightest, most precise and prolific vegetation. Tree leaves (oak, elm, birch?) shimmered in the breeze and light, were bathed in a gentle, indirect glow, born not of the brutal sun, but of a loving moon, or else of nowhere at all, of the trees or of the very earth itself, rich with clay, snails, and roots, an unfettered light, casting shadows, produced by some spontaneous generation, a distillation or evaporation; the central clearing was so pregnant with sap, and the implicit presence of Messiaenic song birds, that the black and white photograph seemed to swell with greens and tender blues; and, at the foot of the trees, in a final provocation, a foaming waterfall, half hidden by a dusting of droplets, mist, a halo, bubbles rebounding, rushed forwards into a joyous, limpid stream across the round pebbles in front of our eyes. The last days of 1960. The last months of the French Empire. Reggane. The Sahara Desert. (In the “French Sahara,” south of Dunkirk, north of Tamanrasset.)

**101 The sand was everywhere. You saw sand, you breathed sand.**

In Reggane, the sand was everywhere. You saw sand, you breathed sand. You ate sand and drank sand. You slept in sand. There was no way to escape it. It was a fine sand, conspicuous but also in-



sinuating, an orange, fluid, winged insect with fine antennae. This sand had the gift of ubiquity. It penetrated into our mouths, ears, eyes, skin pores, and asses; through every portal of the body; like Guillaume Apollinaire, it opened them all (though not lovingly at all). It slid beneath your nails, between your toes and teeth. It colored your hair and beard. Uniforms, fatigues, and boots were dyed by it. Orange. A slightly putrescent orange. And the sky was of the same color. The air and light were colored with sand; the sun, the moon, and the stars. The wind. The nights, to paraphrase Racine, “were more orange than our days.” Our shadows were orange behind us. The sand came from everywhere; tons of it fell from the skies, the winds carried away tons of it, but there was still just as much left behind; an unvarying equilibrium was struck between the arrivals and departures of the grains of sand; the desert kept a perfect, double-entry balance book.

I am sure that it was by evaluating this sand, grain by grain, that the Ptolemaic Alexandrian thinkers managed to conceive, and above all were led to designate, in figures and symbols, the first truly enormous numbers of Greek mathematics (larger than the mysterious “nuptial number” of their Pythagorean predecessors). They needed considerable arithmetic self-control not to keep going until infinity. Archimedes to King Gelon: “*There are some . . . who think that the number of the sand is infinite in multitude; and I mean by the sand not only that which exists about Syracuse and the rest of Sicily, but also that which is found in every region whether inhabited or uninhabited. Again there are some who, without regarding it as infinite, yet think that no number has been named which is great enough to exceed its mul-*

*titude.*” By holding a grain of sand in the palm and thinking of the maximum dimensions, measured in *stadia*, of all the possible areas of beaches or dunes across the huge, but still finite, extent of the earth, it was not difficult to decide that there was necessarily a limit to the enumeration, grain by grain, of all the sand in the world. But naming and then writing down such numbers was quite another matter. The necessary words and signs did not exist. Archimedes had to invent them.

Reluctant to leave me after having adopted me, the sand of Reggane accompanied me in large quantities on the plane back to France, invading my uniform, my linen, my gear, and my thoughts. Months, years later, it would still tumble out on rue Notre-Dame-de-Lorette, from the top of a cupboard, from a sock, from an envelope, from my sleep. The sand had time on its side. And space. It was indomitable in its uniformity. It wiped out all traces of animals and humans both: the skeletons of camels, of adventurers dead from thirst, or else the tracks left by caravans. Sovereign and indifferent, it can hardly have foreseen that it could at any moment receive the insult of being turned into glass.

It was clear that there were three types of men on the base (to express myself like Saint Benedict, separating and judging the different types of monk): the officers, the non-commissioned officers, and the “troops” (I was one of these latter). The officers weren’t lodged at the base, but at the oasis, fifteen or twenty miles away (the most extravagant things were said about the luxuriousness of their camp, for example: they had palm trees full of dates at their disposal, as well as water, and twenty-four hour air conditioning). The non-commissioned officers were on the base with us, but they

slept in “hard boxes,” at least reasonably protected from the temperature. As for the “men,” they slept in tents, about twenty in each (the half-measure of a military wagon = 40 men, or 8 horses (lengthwise); and there were no tents with only four horses).

Lying on my camp bed during the briefest of dusks, beneath the weight of the solid heat, I saw the canvas dome above me fill up with almost substantial, sand-colored shadows, the orangey shades of passersby and vehicles, filtering through the interstices of the cloth, pressed against it, shifting, moving, silently advancing, disappearing, and sometimes seeming to come down toward me in almost hallucinatory visions, brought on by the headiness, thoughtlessness, the overheated stupor. It was then hard not to imagine, as the Epicureans and Lucretius before me, that these shades that were diving down toward me, these impalpable images, were the material emanations of external bodies in movement, like the sloughed skins of snakes, like fragrances or fumes, detached from their surfaces. It was hard not to think that all these objects gave off not only their own intimate substances, but also, abundantly, their colors. It was necessary to avoid being lulled for too long by these visions and becoming paralyzed. I raised my heavy head and forced myself to go to the “club” until night had fallen.

The draftees who shared this idyllic existence with me had mostly been sent to the camp as recruits as soon as their “school days” were over. The regulations covering the years during the advanced state (as in “state of decomposition,” like meat, or a cadaver) of the Algerian War included the so-called “eighteen-month” decree (during a “tour” that now lasted “only” twenty-eight months (at the

beginning; some stayed for even longer)), which made it illegal to plunge recruits immediately into the bath of the “pacification” of Great Kabylia or the Aures, which are charming places, no doubt, but totally lacking in attraction for almost any soldier. However, Reggane lay outside the combat zone, and nothing stopped the army from sending a few draftees to the “North 2000” (an administrative trick) and then leaving them there in the sand to carry out some of the ancillary tasks required for the smooth running of this base (there were also a few “post-eighteen-monthers,” or “pre-demobbers” who were stuck there because of various chance events we won’t go into here). With just a few exceptions, they belonged to the economically and culturally less favored sectors of society. Neither they nor their families had seen “what was coming,” or imagined for an instant what was in store for them when they arrived at the barracks for their “three days” of initial inspection before being inducted. Thus, they had not “prepared” their military destiny, or pulled strings (which they did not have access to in any case) via any family or political influence. Nor had they wanted, or been able, to become non-commissioned officers.

Those I met (for example, the ones who were lodged in the same tent as me) were countrymen from the hinterland of the Morbihan (those from the coast were able to win the coveted status of “navy conscript”), and on several occasions (just as had been the case when I was teaching in Montluçon) I acted as a public “letter-writer,” composing messages to mothers, fiancées, and (real or putative) “girlfriends” (I saw all the photos, I knew all the intimate-yet-chaste details; the reciprocal presentation of photos was a compulsory and ceremonial part of the transaction; in my

own wallet I had one of Sylvia and one of little Laurence; after this exchange, we could talk in earnest). (This was another reason that I had to go to the “club,” so as to meet “clients” other than those from my immediate acquaintance (news got around quickly); I was paid (they insisted on it, this was a transaction, not a favor) in soda, as I did not drink beer (because it was forbidden for mathematicians, I said, just to simplify the matter).)

Contemplating, on their arrival, the unbroken horizon of sand, these recruits had at first felt relieved at being several thousand leagues away from the bombs and ambushes (the very real horror of which had been intensified in their cottages by the “returnees” from this dirty war: a neighbor, a brother, a cousin, someone from the next village) (and when, almost without warning, they had been stuffed into the holds of airplanes along with their kitbags, they felt certain, despite claims to the contrary, that they were going to be dropped quite illegally onto some rocky crag surrounded by “Fellaghas,” armed only with machine guns that they didn’t know how to use (their mistrust of official France was radical, total, ancestral, and absolute)). But when they realized, having soon been informed by the “old boys,” that there was no leave in sight, given the problems of distance, cost, and “security” (just in case they sold our secrets to the Russians (or Yanks)), that there were no towns, villages, discos, or bars in the vicinity; when they had taken the measure (which took about twenty-four hours—but no, what am I saying? two minutes were enough to get a foretaste) of the sun, the heat, the thirst, and the sand; when they understood that they were going to be there for a long time, without any hope of deliverance, the shock to their system was great. Some fell



into depression, or lost weight, or “went off the rails,” or “blew a gasket” (this may well be an anachronistic expression, but I can no longer come up with a better one), becoming aggressive, then insulting their buddies, the sun, the sand, and the non-coms too (dangerous). There were (rumored to be) suicides, and quite certainly suicide attempts (there was one four camp beds away from mine the day after my arrival, with a rather filthy knife). Most of them, after two or three months, no longer said a word and just drank beer after beer, crate after crate, evening after evening, their eyes obstinately fixed on the trees in that huge, mocking mural, and on the waterfall that fell and poured constantly toward them, but without ever refreshing them.

What were they doing there? They built buildings, struck and pitched tents, counted and checked materials, made up a labor force forever at the ready to prepare for operations whose successful outcome relied on their presence, and about which they weren't supposed to know a thing, or want to know a thing, but about which they knew, like everyone else, the essential bits, or more or less. They were young. God! How young and innocent they were! (As for me, I was twenty-eight, had been in the army for a year, and was far less so.) And they stood guard. We were a thousand leagues away from the slightest possible FLN commando unit or hostile population; but this was a military base, and so the guard had to be posted. Either at night (excellent) or during the day (awful, the guard posts weren't air-conditioned). But what they did not do was sweep the yard. None of us, none of them, could have recited with sincerity Poirer and Serrault's military ditty: “I swept the yard / You swept the yard . . .” You may



well point out that there was no yard to sweep—and you would be quite right. Instead, like Roger Lanza, we could have sung of our guard duty: *“Better to do this than comb a giraffe / than sweep the Sahara desert / Better to do this than stay locked up / Better to do this than twiddle your thumbs”* (however, when it came to the fourth line of the song, no one (no second-class soldier in any case) would have agreed. Firstly, we did not say “twiddle your thumbs” but “keep your head down.” Secondly, any amount of twiddling would have been the ideal activity for a “draftee,” and certainly preferable to any so-called military activity, be it guard duty or anything else).

#### 102 The heat, even early on in the day, was intense.

The heat, even early on in the day, became intense. I’ve never experienced a sun that hot. Not even aggressive. Not even insolent. Just hot. The wind—for there was a little wind sometimes—was if possible even hotter. It whipped up the sand and the visibility was lower than in a legendary London pea-souper, concealing Mr. Hyde down a side street, near the Thames. But one day, lifting my eyes because the sun was veiled, and there being almost no wind and thus very little sandy agitation, I actually saw some clouds. I was surprised. They weren’t clouds of sand, or of locusts. They seemed just like clouds of water. I looked again. There was no doubt about it. They were rain clouds, gray and ordinary, apparently swollen and impatient to precipitate. It was going to rain.

And soon it rained. But I received not a drop of it on my clothes, on my face, or my arms. Not a drop, even a scalding one, moist-

ened the sand. And yet it was raining. On the wall of the metal building where I was headed, the oblique arrow-shaped impacts of drops could be seen distinctly as far down as its upper floor. But they failed to fall any lower without evaporating. The storm lasted for ten, or perhaps fifteen minutes. Then the sun came back out. The clouds had disappeared. The rain had disappeared. There was nothing left, not a single drop, not a trace on the gleaming metal wall. Unless, perhaps, momentarily, an odor rose up, a ghostly fragrance of dampness, which was soon covered over and obliterated by the usual, tenacious, underhanded, dense stink of the bins that had not yet been removed from behind the camp's kitchens (do you know that smell? You don't? What a shame, it's really worth checking out).

I didn't suffer from the heat excessively. I was lucky enough to spend many long hours, and the worst of our daily quota of twenty-four, in a solid, perfectly air-conditioned building. I would have slept there too, if it hadn't been locked every evening, after the departure of the last officer—"for security reasons," of course. I would wait in front of the door on ordinary days (I'm not talking about those days of pre-operational hysteria when we had to be up at four o'clock), as early as possible in the morning; fortunately, one of the three air-force lieutenants used to arrive (how I wished there were four of them! I would then have avoided the tedium of "bridge duty," but you can't have everything in life. What's more, those aviators were good kids ("*I love aviators, mother / I love aviators / They have . . . etc.*" (a song from a different war)) who did the right thing during the "putsch" (which was pretty rare, among professional servicemen, to put it bluntly)); and so a lieutenant

with the key would arrive bright and early from his oasis and open the door before the sun became frankly unbearable.

Immediately afterward, with all the unobtrusiveness of a walker-through-walls, the floor sweeper appeared from nowhere, and the three of us took up our work posts: the lieutenant to yawn and fiddle with his radio while waiting for his two colleagues, the sweeper to sweep with his broom or else vacuum with his vacuum, and me to do what I am about to explain. But first, a couple of words about the sweeping/vacuuming. Apart from a few jerboas, there were, as I have pointed out (if I have not yet mentioned the jerboas, with their large startled eyes in the daylight, then that omission has now been rectified), essentially three modes of being on the base: officer, non-commissioned officer, and troop, the specimens of each category being lodged according to their respective ranks and appointed, according to their respective ranks, to their respective, officially regulated tasks.

As the reader may well have suspected, when I said three, I meant four (this lesson from Alexandre Dumas (read when I was nine) did not fall on deaf ears). Among the ancillary tasks, some, presumably even more ancillary than others—such as sweeping/vacuuming (an unremitting labor, given the sand's gift of ubiquity)—were reserved for a fourth species of man (not woman! I won't dwell on this aspect of Saharan life, except to point out in passing that the sand was extremely unfavorable, according to the general opinion of those on the base, to the solitary relief of Saharan solitude), called PLBTs, who were civilians "requisitioned" locally (in the broadest geographical sense), and then designated with the name of a "tribe" that was unilaterally assigned to them: in this case

*Populations Laborieuses du Bas Tuareg* (or “Laboring Peoples of the Lower Tuareg”).

The PLBTs were rather like “untouchables.” Second-class soldiers weren’t supposed to talk to PLBTs, and vice versa. As a matter of fact, no one, so far as I know, ever tried. Not in one direction (second class  $\rightarrow$  PLBT), and even less in the other (second class  $\leftarrow$  PLBT); communication was blocked not only by precautionary and disciplinary obstacles, but linguistic ones as well. Thus, PLBTs were sometimes seen, but never heard. When the translation of the phonetic term “peelbeetee” was at last revealed to me, it opened up vast horizons, throwing a thrilling light on primitive mentalities that were still so vivacious even in the latter half of the twentieth century (by “primitive mentalities,” I mean all the beliefs and superstitions belonging to the general *weltanschauung* and that reigned in the heads in the upper military and political echelons of the (both fifth and fourth) French Republic).

“PLBT” was a sort of marvelous linguistic artifact, and I sometimes discussed it with the two or three of my “colleagues” who were, like me, struck by its originality. It provided us with an indirect, yet effective, way to talk about something else, and something that we could not really discuss openly; it did us good. A little.

For example, one question particularly fascinated Albert, a lad from Ploërmel, who was a bit of an anarchist and whose propensity for subversive ideas had clearly escaped the gendarmes who had investigated him before he was sent to this extremely “sensitive” post: should the PLBTs be considered as beings even lower down the human ladder than we second-class soldiers? There were points both for and against. “They get bawled out even more

than us." "Yes, but they don't have to go on guard duty." "Or wear a uniform." "But they're not even French!" "Do you think that's a sign of inferiority or superiority?" Albert would ask. "We won't always be second class, we'll get demobbed and go home. But they'll always be PLBTs." "Think so?" Albert would ask. "No, but I mean, just look at this country. And this climate!" "Maybe they like it here." "We don't know what they think." "And do they know what you think?" *Et cetera, et cetera.*

But they did have a considerable advantage over us: a far greater liberty of movement, which was relative but also real (a longer "leash" around their necks). If they had been monks, and been really free, then they would have been of the sort that Saint Benedict called *gyrovagues*.

### 103 Once, in the office, I had a whole day of comfort in front of me

Once, in the office, I had a whole nine-to-five day of comfort in front of me, occupying a privileged position. The arithmetical duties that justified my presence in that precise place did not take up very much of my time. I was left pretty much alone (except for bridge and the occasional visits of even more superior superiors; bridge duty was not in fact all that frequent because, having been instructed by my grandfather, who was a player of the old card game *manille coinchée*, the moderation and prudence of my bids was no doubt excessive (never higher than "two no trumps," outside of exceptional circumstances), which always annoyed my partners; I was called on only as a last resort; what's more I did not



play “belote” (the “second-class” game *par excellence*)), and the temperature was cool.

And, marvelous to recount, each floor of the building also boasted inexhaustible water distributors, those dispensers of drinking water invented by the US army and, thankfully, adopted by ours; they were veritable Saharan “Wallace fountains” (an ornament that has now vanished from Paris’s squares), which refreshed you internally (glottis and vestibules) at regular intervals, thus allowing you to think without too much apprehension about your subsequent un-air-conditioned hours in the evening and at night. Some of my fellow calculators used to get bored. I did not. I read. I had just one book to read, but I was unlikely to exhaust it in the few weeks (at most) of my stay. It was a book of mathematics. It had just been published. It was in a large format, with a blue cover. Its title was *Elements of Algebraic Geometry* (affectionately and familiarly abbreviated, in French, to EGA). Its author: Alexandre Grothendieck. However, Grothendieck had not written the book. He had provided its conceptual substance, but it had been drafted by one of the popes and founders of Bourbaki, the greatest (in size), the heaviest, and most peremptory: Jean Dieudonné (→ § 61)).

The Institut des Hautes Etudes Scientifiques, which had recently been set up in Gif-sur-Yvette, had financed the publication of the first fascicle (the start of what was intended to be a very long series) of a colossal enterprise: the presentation of the Grand Grothendieckian Theory of Schemes. Its horizon: the famous “Weil conjectures.” Then a further, more elevated horizon, the Everest of mathematics: the ultra famous “Riemann conjecture.” At least, such was the “buzz” that accompanied the book, which had been



transmitted to me long-distance via various relays, and which had incited me to purchase and read it. I savored it slowly, calmly. I had all the time in the world. I had time, and, in a way, the book had come to me at just the right time.

For I had so immersed myself in Bourbakism that such a text, the fruit of its final flowering, the monumental work of he who could be considered as Dr. Frankenstein-Bourbaki's Monster, and which had been drafted according to the group's inimitable stylistic norms, here applied, in its prose, in a heightened, frenetic way (for example, in the notation of the paragraphs and subsections, which had become almost as dense as those of the *Tractatus*), ran through my mind like honey, no, like nectar, an intellectual ambrosia. Just thinking about it now fills me with stupefaction. I was someone who managed to read EGA with pleasure—worse, with delight. For any normal mathematician today, such an affirmation would seem as perverse as adoring an American soft drink, such as my favorite, root beer.

No doubt, my desert surroundings helped. But I continued reading the book after my return home—as well as its subsequent fascicles—with the same pleasure. In fact, my entire “mathematical history,” from my arrival in the lecture hall of the Institut Henri-Poincaré, as described in chapter one, had prepared and conditioned me for being precisely this sort of reader.

The Dieudonné locomotive, like one of those huge, vertiginous machines that Victorian engineers used to launch onto the British railway network in the golden age of steam, advanced along the rails of deduction with (to my eyes) a dazzling mastery and a sovereign disdain for imagistic illustrations, metaphors, remind-

ers of the historical origins of problems, or the long explorations that, at least since Descartes (if not the Greeks) had paved the way for the birth of this very theory. The idea of Schemes seemed to have emerged fully armed from the head of its creator, Alexandre Grothendieck. At the same time, what was especially admirable (for me) was the way in which Dieudonné, with a touching modesty for a mathematician of his weight and reputation, had unhesitatingly put his skills at the service of a man twenty years his junior, thus becoming the attentive, exact, conscientious scribe of this new way to envisage algebraic geometry.

The preface warned that the notion of Schemes, because of its novelty, power, complexity, and amplitude, constituted a rather large step forward. For this reason, it would require a correspondingly large effort of adaptation and abstraction from geometers who were used to employing a different language. But, we were reassured, the effort would be worth making. And then, the preface went on, it would certainly be no greater than the effort made in the past by our fathers (he meant his fathers, not mine) when they first approached the theory of groups and then the vocabulary of set theory. As I was absolutely not a traditional algebraic geometer, and as I had only rather vague ideas about the problems contained in this branch of mathematics, this posed no difficulty for me. In fact, when well explained (using a method quite different from the one adopted by Dieudonné), the continuity and, in a sense, the natural evolution of this discipline—dating from its initial problems, which can be formulated in an elementary way—right up to the “Schemes,” can all be easily understood by advanced students. It has taken less than one generation in the

community of geometers for this chasm, if ever there was one, to be filled in.

But, in fact, the difficulty was quite unlike the one that Dieudonné's "fathers" had confronted at the beginning of the century. At that time, there had been a radical upheaval in the ways people wrote about and described mathematics. If my own reading of EGA had been so "natural" (independent from any real understanding of the problems it raised), this was because the text before me had been written and conceived according to the very same way of seeing mathematical objects that had become universal since the days of David Hilbert—the same one that still dominates the ethos of today's "working mathematicians." This was true to such an extent, in fact, that I ought now to write, or even cry out: "Then, suddenly, in a flash as violent as an atomic explosion (haha!), I understood that . . ." In narrative terms, here is a chance for some histrionics, or an inner revelation. Abruptly, right there in the middle of a huge desert, "right under the sun," and at that precise historical instant (even if, in the end, it turned out to be just a "minor" historical instant), I would have understood that there was a different, absolutely new way of conceiving mathematics; that I now just had to explore it, and in this way lay my salvation.

However hard I search my memory, however, I can see no such illumination at that time. What a pity. And yet, a bifurcation indeed took place, in about that year, in my modest progression as a mathematician, with considerable consequences (for me) in my poetic evolution. Little by little, after returning from Reggane, I felt increasingly sure that the route I had fol-

lowed thus far was going to become, and so had already become, a blind alley. I could read more books, delve more or less deeply into the countless, fascinating theories that proliferated explosively in every algebraic direction. To what end? To find what, in one of its branches? As the things I read and the seminars I attended grew closer to the contemporary state of these theories, the more clearly I saw that the comprehension which had been my objective meant more than just understanding existing results, and would require confronting the unknown, the unthought-of, the unproved, the undiscovered. And so, become a “researcher”? But I wasn’t even sure that I was capable of doing so; and even if I were, I could at best just fill in some tiny corner of a tiny corner in commutative or non-commutative algebra; while doing so, I would lose the vast, almost galactic vision that Bourbaki had given me. Why? Because I could not do everything at the same time. Because, in any case, I had started far too late, and I would never catch up. But there was an alternative vision, an entirely different way of seeing mathematics. I’m not going to talk about that now. But there lay my route. Without this, I could not have conceived of my **Project**. (Without its existence, I would not have staked, and lost, my life (damn the thing! and damn its inventors, Messieurs Eilenberg and MacLane!).) Going back in time, as I’m doing, to before its collapse, even to before its conception, its pre-beginnings, this bifurcation away from Bourbaki was clearly a decisive event. Here was another, a new route. What stops me from fixing right here the zero point of that route? Nothing.

## 104 France had decided to “get the bomb”

France (its will having been identified, interpreted, and expressed by its president, elected by direct universal suffrage (which is surely proof?), Charles de Gaulle, who had always been in personal, direct communication with it), had decided to “get the bomb.” An atomic weapon was necessary to its independence. To “get” the bomb, and make enough, reliable, dissuasive, operational copies of it, required experimentation. So France had to test a few prototypes by exploding them. It was out of the question to conduct such experiments on some rural plateau. But France, back then, was huge. It stretched far down into the southern hemisphere and owned vast swathes of the Sahara. So, after much thought (an *analysis situ* of a specific sort), a “site” was chosen; and the selected “site” was Reggane, somewhere far away in the desert. (We weren’t supposed to know where Reggane was exactly, for—surprise, surprise—“security reasons.”) The physicists and the civil and military engineers working for the army did their job. A “base” was built and inhabited. The bomb was transported there. A general was put in command. A putative date for the big day was fixed.

More exactly, a certain “launch window” was established. But it was hard to be sure in advance which day it would be. Why? It was simple. A large rectangular of the Sahara, called a perimeter, which was already naturally a desert, had been desertified even more radically and was now a forbidden zone, maybe not to jerboas, but at least to travelers and PLBTs. In those days, there was no question of conducting underground tests. A suitable, unin-

habited area was chosen, the necessary was done, and boom! The bomb went off in the open air, like a firecracker on July 14th (*vive la France!*). A superb mushroom rose up in the sky, and the job had been done! Yes, but . . . But this mushroom full of different sorts of severely radioactive dust (chemical elements taken from the more exotic regions of the periodic table) wouldn't just sit still. Most of it no doubt fell straight back down again. But the winds in the upper atmosphere (and the lower one too, for that matter) would carry away a large part of it. It must be admitted that the destination of these particles and their final point of arrival were strictly a minor concern to the authorities. The particles would have plenty of time to become dispersed and diluted before reaching Algeria and the Mediterranean, Timbuktu, Chad, or the south of Morocco and the Atlantic.

There was just one snag; whichever the direction of the wind, there were certain people likely to catch the fallout from the atomic cloud regardless: namely, us. We weren't all that far away. The bomb could hardly be set off if, for the following hour, it was going to spit radioactive, possibly lethal, debris over our heads. It followed that the whole operation depended on the caprices of the weathervane. As such, a few hours before the supposed time of the explosion (just prior to dawn, so as not to have to compete in its brightness with our good old sun), it would be necessary to plot the trajectory that the post-mushroom cloud would follow, according to available meteorological data. If it headed east, north, or south, then everything would be fine. In those directions, the only risk would be for it to pour down feebly onto deserted regions (or else inhabited by such dispersed and negligible populations that there



was no point even thinking about them). The green light would be requested from Paris, the official communiqué prepared, and the general would give the order. Pop! Boom! Boom! Crash! Bang! (Or something like that.) But if the mushroom unhappily turned its head westward, in our direction (I say “west” rather than north, east, or south; even thirty years after the fact, I have no intention of divulging “official secrets”), then everything would have to be put off until the next day, at the earliest (and then the next day, the same problem would be posed all over again, which was relaxing for all those eggheads from the Polytechnique who filled the base, considering the heat!).

But the outcome didn’t just depend on the weather. The physical-chemical nature of the cloud also had to be borne in mind. Its composition could of course be more or less predicted, but it would have been more reassuring if there had been precedents to point back to, which was unfortunately not the case. Although, in reality, there had of course been precedents. Our great cousins, the Yanks, had already conducted a large number of similar experiments (including two real-life ones, with well-known results). The US army had produced an entire library of reports and analyses on the circumstances and effects of atomic explosions. And the French army had indeed obtained (honestly? a good question, given the lack of enthusiasm in the United States concerning General de Gaulle’s desire for his own A-bomb, but I will not indulge in pointless speculations on this matter) a number of American manuals on such questions. I had one in my desk drawer. (I was tempted to make off with it, but I prudently gave up on the idea.)

Thus, a highly specialized detachment of our glorious army, commanded by a colonel (from the Polytechnique) and made up of a few officers and several non-officer draftees (scientists), was charged with the modest but vital task of forecasting the position of the cloud at  $H+1$ ,  $H+2 \dots H+n$  ( $n < 24$ ), then  $D+1$ ,  $D+2 \dots$  in other words, at one hour, two hours  $\dots$  then one day, two days  $\dots$  after the explosion. More precisely, it was necessary to trace out on a map of the region the contours of the estimated radiation on the ground. To do so, we had a formula, a gift (?) from the Americans, which we only had to apply and then transform into clearly legible geographical data—legible even for a general and his staff. (This formula contained absurd approximations and obvious inexactitudes, and could quite easily have been improved upon, as our colonel soon pointed out to the relevant authorities, after hearing our own observations; but in vain; we quite simply hoped that the consequences of these failings would be limited.)

As soon as the launch window arrived, according to the calendar (after the obligatory period of preparatory exercises), an immutable ritual began: awoken early, very early, we arrived sleepy and feverish at Building X, recorded all the temperature and wind data, rapidly made all our calculations, and then drew out the results in succulent colors on the large map in the meeting room. The general arrived an hour before the potential H-hour, and peered with his experienced eye at the map. Then left again. This went on for some time. During the first few days, the weather was favorable, and we pictured ourselves already back in France, but the general didn't even show up during this period, because Paris had not yet given the go-ahead.

Then the winds turned against us. They began driving the lethal cloud directly at us, invariably and with a meticulousness that displayed an almost blatant desire to do harm. This is why the general's eye grew so sharp and experienced. Every day, it was quite clear that the map was showing the very same catastrophic distribution of "y" units at a level that was far, far too high (we wouldn't have lasted long) (it was out of the question to designate the units of radioactivity by their proper name, just in case the PLBTs, when sweeping the room . . .). And so it went.

I had no sympathy for atomic weapons, and no enthusiasm for de Gaulle's ambitions to possess one. After four months in the army—after I had failed, successively (thanks to procedures like those in *The Good Soldier Schweik*), in my attempts (compulsory and voluntary) to become, first, an officer, and then, as a "second chance," to become a noncom—the bureaucratic machine had, given my position as a Mathematics Assistant at the University of Rennes (and, I think, from what I saw of my file (quite illegally of course, thanks to a well-placed "second-class" bureaucrat, following the finest military traditions), because I taught applied classes for the "Certificate of Automatic Calculation"), dispatched me to Fort Aubervilliers in order to join the detachment of cloud calculators. I didn't long remain ignorant of what I was going (in quite a modest role) to be a part of. But, by then, I could no longer pretend I was unsuited to being posted to the Sahara.

That is, I absolutely didn't want to attract attention by expressing any patent ill will toward their project. For me, the Algerian War was an infinitely closer and more immediate evil than the atomic threat (given that what was called "the balance of terror"

seemed to neutralize the latter). I wanted to avoid getting directly involved in the war for as long as possible, and preferably forever. What's more, I was curious. I have never regretted it.

**105 Apart from the rather rudimentary calculations called for in our work forecasting fallout,**

Apart from the rather rudimentary calculations called for in our work forecasting fallout, the American handbook that we had at our disposal explored, with an almost lunatic attention to detail, all of the aspects of the post-explosion. The book was clearly based on a number of tests, but gave pride of place (so to speak) to the two most satisfactory experiments so far, in terms of the American army's Cold War viewpoint: Hiroshima and Nagasaki. And it was written in terms that were offensive rather than defensive.

Each series of data and each graph were accompanied by annotated photographic illustrations, without even the most rhetorical concessions to any possible sensitivities the reader might have inherited from civilian life. The prose was measured (though wooly) and "matter of fact." An entire chapter was devoted to the examination of the state of the "personnel" (hypothetical soldiers in wartime, though the only available real-life examples were non-combatants) who happened to be nearby the initial detonation; the data that had been gathered (by the Japanese, then by the occupying forces) was divided according to various criteria: distance from the point of explosion; nature of the obstacles encountered by the shock wave, or by the heat wave or by the downpour of virulent radioactive particles, among others.

This resulted in an impressively pre-postmodern series of images. The handbook's authors seemed to have been unfavorably impressed by the fact that there had been so many survivors, at least during the first few hours. They were put out. They did their utmost to understand why and had set up a few tests to make sense of it (using models).

I remember a passage that I found particularly striking (not being able to guarantee the exactitude of the numerical data, I have omitted them): if a mass of earth of height  $x$  and depth  $y$  intervenes at a distance  $z$ , there is a risk (the word they used) of there being a certain (excessively high) percentage of survivors. I can also remember another section, fit for an anthology of horror scenes: half a dozen Japanese people (perhaps still alive) from Hiroshima, photographed from behind; on one of their deeply burnt backs, the negative image of a window; on another, the shadow of a metal mesh: this image brought to mind a rather peculiar sort of microwave oven (or Saint Lawrence on his traditional gridiron (as everyone knows, this legend derives from a mistake made by a medieval scribe who, when copying a manuscript, absentmindedly skipped a page and shifted without any transition from the life of a saint to a recipe)); in another picture, like a new Turin shroud, a black figure seemed to have been impressed onto a piece of fabric.

One of those early mornings, the colonel brought a few members of his team to inspect what would be ground zero. The planners of this new form of spectacle had done a good job. All around, over a radius of at least one kilometer (around a central point that was, in fact, inaccessible), as though for the reconstitu-



tion of a historical battle with lead soldiers—only, in this case, “life-size ones”—they had distributed a large amount of material of various kinds, such as tanks, machine guns, jeeps, planes . . . in various positions, in the open on little sand dunes or sheltered (?) in trenches behind them; and each piece of military equipment had its crew of models, dressed in the best quality, brand-new uniforms; there were infantrymen, artillerymen, pilots, and even sailors; and all ranks were represented (did they want to examine the variations in the effect of a bomb in terms of each person’s position in the hierarchy?). No expense had been spared. We couldn’t believe our eyes.

The colonel made no mention of all this. He was a taciturn, rather placid, and absentminded officer, preoccupied only by his constantly renewed and always unsuccessful attempts to prove Fermat’s last theorem. He always had at his disposal a draftee from the mathematics unit whose job it was to check the latest state of his attempts and, with the greatest possible tact and discretion, point out its failings; the colonel, disappointed once again by this negative verdict, put his manuscript away in a drawer, after duly securing it with a seal of “top secrecy,” and then thought no more about it—until his next fit of acute fermatitis. I had been warned. His “proofs” were always elementary, purely arithmetical, and fortunately quite easy to refute. But, luckily, I never had to rack my brains over one of his drafts; because the colonel was in a period of “remission,” or else because the general agitation stopped him from concentrating on his real problems.

Finally, the great day arrived; the Parisian augurs and the winds declared themselves to be favorable simultaneously. All person-



nel were confined to their respective tents and buildings, and absolutely forbidden to go outside. It was still night. The camp seemed dead. The pale gleam of the coming dawn crept up. In the office where I had been sitting for the past few hours, "thousand-sun" dark glasses were handed around. We waited. The colonel looked at his watch. We went to the window, our eyes stubbornly fixed in the correct direction, which we knew, of course, after our days and days of calculations, down to the last second of the arc of the circle of the horizon. But someone moved, shifting a few inches in front of me at the decisive moment. I didn't see a thing.

In his biography of the physicist and Nobel Prize winner, *Genius: the Life and Science of Richard Feynman*, James Gleick describes the effect of the first of all such explosions, in Los Alamos in 1945, on some of the scientists who had contributed to perfecting the bomb: *"The test seared images into all their memories: for Bethe the perfect shade of ionized violet; for Weisskopf the eerie Tchaikovsky waltz . . . for Feynman the awareness of his 'scientific brain' trying to calm his 'befuddled one,' and then the sound he felt in his bones; for so many of them the erect figure of Fermi, letting his bits of paper slip through the wind."* And he adds: *"Two days later, calculating that the ground radiation should have decayed sufficiently, [Fermi] drove with Bethe and Weisskopf to inspect the glazed area that Feynman saw from an observation plane. The molten sand, the absent tower* (where the bomb had been placed).*"* The demon of curiosity had been irresistible. These physicists were the first to succumb to the Temptation of the Zero Point.

On the morning of the big day, in Reggane, I had the fortune to witness, by ear, through the wall that separated us from our boss's office, a memorable scene. Less than an hour after the devastating flash that announced to the world the arrival of a "French" atomic bomb, a parachute captain, who had ended up on the base for some mysterious reason or other, took a jeep and unhesitatingly headed straight for the site of the explosion. He was intercepted by a surveillance patrol just as he was entering the forbidden perimeter and unceremoniously brought back, despite his vigorous protests, and asked to explain the meaning of his actions, which seemed incomprehensible to his fellow human beings. Their voices could be heard perfectly from the adjacent room. The colonel was beside himself. He wanted to know if the captain was drunk, insane, or suicidal. But the captain was unapologetic. He didn't understand what he was being accused of. It then transpired that he considered radioactive particles to be nothing more than hostile projectiles of a somewhat smaller caliber than those of ordinary weapons. He had headed off to plant a tricolor flag at the zero point. He had survived the bullets of the Vietnamese in Indochina, and he was hardly going to be scared of some pathetic volley of atoms.

## Descriptive Table of Contents

There are four chapters, making up the story part of the book. At certain “points” in the text of the first three chapters appear interpolations, like long parentheses developed to a greater or lesser extent. They can be omitted from an initial reading. Finally, there are two bifurcations, which represent alternative narrative directions that could have been taken in this work. Each chapter, each set of interpolations, and each bifurcation is divided into numbered moments, the content of which is evoked in the following descriptive table of contents, thus allowing readers to navigate. (It would perhaps be of interest to start reading the book here.)

### Chapter 1 (story): *Incipit Vita Nova*

#### 1 **There were three exits**

The first at the top, to the left – I used to arrive early – The lecture hall filled up – Between the beginning and end of the lecture – Outside, the sunrise – I turned round – So I listened absent-mindedly – But “Choquet” – Mathematicians, in people’s typical representations.

## **2 A few years ago, my friend Pierre Lusson and I**

At the Department of Mathematics of the University of Paris-X (Nanterre) – Encouraged by this initial conversational success – For, when confronted with Mathematics – In the same way, confronted by a sudden metamorphosis – An almost palpable disarray – Some, such as Sonia the dancer – When looking from the door – At the time, the professor – I am standing, looking down from the heights of the amphitheatre.

## **3 Behind that door lay a protected space,**

A professorial sanctuary – The professor's ceremonial entrance – Much later – In May or June – As the morning wore on – The third entrance to the lecture hall – It was through this third exit – In those days, murmurs – It was a stupefaction that I shared.

## **4 This book will no doubt only feebly justify its provocative title**

I should make that clear before proceeding any farther – The person, here, who says "I" – But it is also true that this book's title – An axiom, borrowed from Gertrude Stein – A book is the autobiography of its title – I open my window to the air – But before erasing it, I charge it with meaning – The mathematician I used to be – I no longer feel guilty.

## **5 What caused the anxious stupor of the Integral and Differential Calculus students**

The sudden arrival onto the scene of knowledge – During the next few years – Its emblematic simplicity – Fig. 1 & Fig. 1 with caption – We looked. We did not understand – The reasoning that followed – But we were going to have to get used to it – The sociological importance of the moment – I was there, among them.

## **6 The moment that I am marking out, symbolically, one winter morning,**

Extreme difficulty and dismay – I was not a “natural” mathematician – This comparison with athletes – This universal vision has reached its apogee in France – I would never have fulfilled it – Gripped by a sort of revelation – The route that mattered most to me: poetry – **I’ll be a mathematician!** – This sublime idea illuminated me all summer.

## **7 I have highlighted an analogy**

By virtue of a decision – I did not want to compose mathematics – I did not know what that really meant – I wanted to understand, and that is all – I hoped that there might be indirect benefits – There was a further difference – The scholarly approach to poetry – The vision, both exalting and reasonable – Went swimmingly.

## **8 But not for long**

The novelty of my situation had not yet lost its charm – When I say “fairly well” – Problems with physics – Alarming and unexpected – Why persevere? – Gripped with dissatisfaction – I did not understand what I had come there to understand – A large dose of the “same” – My second year was a disaster.

## **9 In the month of May this year, the weather is changing gradually,**

The early hours of the day are still cold – Then, with the sun, it soon gets hot – The Tuileries garden is being renovated – A fit of transparency – Notice boards, which I have never seen anyone read – The sun, helped by a little wind – Immersed in coolness – I had found this word: Mathematics – Yet, it really was another life that I was being given.

## Interpolations in chapter 1

### 10 (§ 1) **evade the vigilance of the college janitor**

Secretly in league with the Bourgeoisie – He played both roles with zeal – But he now had his hands full – He spent a large amount of his time watching out for our transgressions – At the hottest moments of their protests – These must have been difficult times for him.

### 11 (§ 2) **Apparently, a clean slate had just been made of the past of mathematics**

“Bourbakism” seemed to wreck the entire edifice – Another “clean slate theory” – This “revolutionary” choice in mathematics – A further parallel needed to be drawn – In poetry, too, the old world had been torn down – A clear contradiction.

### 12 (§ 3) **“alpha point alpha point alpha alpha point point point”**

The incomprehensible form of quite a simple object – Fig. 2 – With its roots in the air – We can then group together the groups – “Polish notation” is more “economical” – The geometry of an arborescence.

### 13 (§ 3) **another door, lower down still, this time to the left of the blackboard**

One Saturday morning of that same month – But I had made the journey in vain – I slowly walked around the building, taking rue Pierre-et-Marie-Curie – The contradictions in my memories – The commitment to veracity – I went back on a weekday.



#### 14 (§ 4) **a book is the autobiography of its title**

If I see on the cover – It will not be about the life of mathematics in my own life – A biography of what I call the **Project** – An embedding – Dependence and “embeddedness” – Relationships.

#### 15 (§ 4) **images entwined around one another appeared in response to a narrative decision**

Necessarily set the memory in motion – Each voluntary attempt to resuscitate the past – In this branch, as in the two preceding ones – The functional strategy of this memory game – The approach in this particular branch is the opposite – I prune back any overgrowth that exceeds my intentions.

#### 16 (§ 5) **the rectangles, squares, and diagonals sketched out by Socrates in *Meno***

(*Enter Mr Meno, Socrates and the Boy.*) – Tell me, boy – ? – I admire your courage, and pity your youth – Um! – A “famous” error committed by Lebesgue – The knowledge of sets was within us.

#### 17 (§ 5) **many of them underwent a genuine conversion**

Different generations – Apostles of a new mathematical religion – Collective mathematician – An even more serious problem – The next generation were their immediate followers – The fourth generation, the followers of the followers – In poetry, the Surrealist heritage.

#### 18 (§ 6) **So, I said to myself: I'll be a mathematician!**

This is how I recall it – The workings of this particular tale – The absolute independence of my poetic activities – But why stick to just one language? – Cabbage soup – Polish grammar.

19 (§ 18 cont'd) **But, language studies at the time touched on linguistics only as “history”**

Initiated, not without tears, into “Old English” – The belated offspring of the highly mysterious “Indo-European” – A bewitching universe arose before my eyes – The dizzy heights of Hittite – It may seem strange – The reasonable reason.

20 (§ 7) **all there was left to discover (and discover quickly) was the path that led there. This is barely even an exaggeration.)**

Overheated intellectual climates – Their previous ideas remained more or less unconsciously – Knights, tournaments and duels (in the “Alexandre Dumas” sense of the word) – This would surely have warmed the heart of the inventor of the zero – An associated idea – Geometry is intrinsically superior to algebra.

21 (§ 20 cont'd) **It is in the light of the above that I shall attempt to interpret this statement**

Replacing calculations with ideas – Arithmetic possesses therapeutic power – What is this for? – Found particularly repugnant that the process of proof could itself be made calculatory – Against all those obscure paradoxes – A few disdainful, serene sentences.

22 (§ 7 & § 8) **the discipline, rigor and severity of calculation seemed to me to be a possible mental insulation, and even a protection (for someone possessed of the mental ability to calculate)**

Algebra had always appealed to me – An *ad absurdum* reasoning which was pursued over more than 400 pages! – The immaculate deductions

of the Treatise – These calculatory sequences provided certainty – Being part of a collective, universal, shareable certitude – Gift of geometric divination.

23 (§ 22 continued) **I sought out arithmetic.**

To protect myself. But from what? – A transposition of poetry towards mathematics – But this formal liberty – What I concluded about this awkwardness – My state of desolation, almost of shame – Nevertheless, though I was only to discover the fact later, I now held the solution.

24 (§ 9) **Totally immersed in coolness, and facing the rippling glints in the pond,**

I get out my little notebook with its oblique lines – I then remove from the right-hand pocket of my trousers – A piece of encomiastic “oral prose” – It is, thus, Saturday May 23<sup>rd</sup>, 1992 – But why, you might ask? – She opens the door with her key.

25 (§ 24 continued, part 1) **The other day, Marcel said to me on the phone:**

What if we gave him something Oulipian? – “That’s what I thought,” said Marcel – So, yesterday morning, in the Tuileries – Miserably – After half an hour – What to do?

26 (§ 24 continued, part 2) **What is to be done? as Lenin once asked.**

Not only was this meager – The only suitable fragment – You can consider these scraps – banjo, jejune – Ob – Ignorance of Galois is no defense.

## Chapter 2 (story): General Bourbaki's Coup d'Etat

### **27 That machine for manufacturing recollections, my memory,**

A voice interrupts the lecture – What the voice is saying starts with “but” – Implicit in the initial “but” – Choquet breaks off – Paradoxically satisfied – He turns towards the board – The image moves down – Their faces do not matter much – The brief dialogue which followed.

### **28 At the moment I am writing these lines (in May, 1992),**

The “biography” of that many-headed beast is still to be written – A collective pseudonym – A school joke – These “young men” of 1930 – Mathematical water has flowed under bridges of the same kidney – In 1954, their name had hardly spread – This moment acquires a solemn dimension – The essential revelation – That monumental work.

### **29 In the beginning, it was as a treatise that I imagined Bourbaki, far more than as a group.**

My reaction was slow – I have a long experience of procrastination – The discovery of the existence of Bourbaki – All through that numbing winter – None of my friends from my prep class – I knew no one – Three of those students – I search, with the inner gaze of memory – Any pardon will be entirely posthumous.

### **30 If you accepted the revelation that there was a new prophet of mathematics,**

Three strategic lines – The line of pure obedience – Incongruous, fantastical way – Respect the traditional pact of education – Impossible to

make her budge an inch – I do not know how she had managed to carry on despite the skepticism – “That’s not for poor nigger girls like me!” – There was more than just renouncement – The combinatorics of heavenly motion.

### **31 For Philippe Courrège, on the other hand, his belief**

A genuine conversion – He was immediately put out – The inner turmoil caused by these reflections – A radical conversion – The model of the “believer” in Bourbaki – I do not have the daring of the novelist – The abstract, restrictive approach – This would be impossible in one case – Chemical, intellectual reaction.

### **32 for Philippe Courrège**

With paper, pencils – By adopting Bourbakian rigor – The “Jansenism”, of the approach – Mathematics was not a concatenation of terms – Hurriedly, almost angrily – Writing, crossing out, rewriting – “Started from nothing, comma . . .” – The power of conviction and discovery – A carpenter of propositions.

### **33 He said that he had no mathematical intuition or imagination**

Not only did he refuse to give any value at all to intuition – The “pathetic spectacle of a continuous function without derivative” – A game played with symbols – As part of the ethical component – Incorrectness was the only real crime – Portrait deduced from a single axiom – It should also be clear – To brand with the “axiomatic iron” – The question of Probabilities.

### 34 **By naming my third pictorial model as the model of pure anticipation**

Lusson's position – Appalling simplification – An interest only in what will come afterwards – In other words – Years have passed by – As with any rapid, intuitive approach – The inner deductive sequences – If exceptionally – He would have preferred things to be taken more slowly.

### 35 **“At my age, Galois was already dead”**

Disenchantment – The development of theories, always being anticipated – When viewed externally, Grothendieck – I have provided a glimpse – It was impossible for me not to know – Outside this piece of the world, explained by mathematics – I was not, and never would be – Become a mathematician by simply deciding to do so – Begin at the beginning.

Interpolations in chapter 2

### 36 (§ 27) **Nor does he call upon the rest of the lecture hall as his witnesses, as his colleague “Schwartz” used to do rather histrionically before him**

Then almost at the zenith of his prestige – A sort of ideal, trans-generational class – The prestigious Fields Medal – The ill will of Mr. Nobel – The entrepreneur's thunderbolts – An irate pen stroke.

### 37 (§ 36 continued, part 1) **However, the originators of the “Fields Medal” had emphasized their disdainful refusal of any assimilation with the Nobel prizes**

Four-yearly medal winners – This periodicity as a discreet allusion – An Olympic dream? – Ostentatious originality – Prestige in the “milieu” – Virtue gained “by default”.



38 (§ 36 continued, part 2) **Schwartz regularly set off a shudder of stupefaction in lecture halls**

Iconoclastic teaching techniques – The Theory of Distributions – Participating in the beginnings of a general upheaval – He would pronounce the terms of a theorem – Our attention was inevitably drawn – Silence fell in the lecture hall.

39 (§ 36 continued, part 3) **The vast majority of those present always voted for the wrong answer**

*The Village that Voted the Earth was Flat* – Those who had voted blindly – They had not listened to the question – This was generally my position – Why was their answer always wrong? – Just plain ignorance.

40 (§ 36 continued, part 4) **This was thanks to the conjunction of two factors**

In these given conditions – He was (let's not mince our words) stunningly intelligent – Secondly, he was careful – Well-known mathematicians even fell into these traps – He wanted to teach us to be prudent – Some time later, I discovered.

41 (§ 38) **another tic, which flung his shoulder upward in his jacket, thus creating the impression that he was shrugging up a bra strap that had unexpectedly slipped down**

This recollection, which I have just garnered – Pierre, always at the cutting-edge of technological progress – New detail to an identikit portrait – Izumi burst into tears – Forgotten, characteristic gestures – The revised image had always been there.

**42 (§ 30) a source of serious conflicts, in which everyone in my mathematical “generation” became more or less directly embroiled**

Preparing to take the “agrégation” – But there was now a snag – In some places (the Institut Henri Poincaré . . . ) – The *Normaliens*, whose abilities had already been proved – Some refused to take it – This movement gained momentum.

**43 (§ 30) at “Plantin,” the café at the corner of rue d’Ulm and rue Lhomond**

The verb has not been chosen by chance – Père Plantin presided over his bar – We swamped it, adopted it – But his joviality was severely put to the test – He recovered the use of speech and smiled – A long time later, we went back.

**44 (§ 30) before passing the *agrégation*, which so pleased her father, who was a math teacher himself, but without this distinction**

She passed in 1960 – Culinary hospitality which was doubly marvelous – Mr Espiand was tall – He placed Sylvia and his daughter on either side of him – The real consecration was the “agrégation” – For the occasion, there was a large colombo.

**45 (§ 30) she would surely have excelled in the combinatorics of heavenly motion, if only she had allowed herself to want to**

She calculated remarkably quickly and accurately – Our studies were over, for better or for worse – Through a chance meeting – I suddenly want to cry – There were several reasons for her refusal – A Lycée, in Digne.

**46 (§ 32) He clearly saw himself as a craftsman, a maker, a *fabbro* of deductions,**

Adopting the posture of a craftsman, in the old sense – Mathematics is shot through with the doctrine of inspiration – Ideas and are not the fruit of labor but a gift – It is difficult to acquire even a meager right to legitimacy – But the Bourbakist approach – Genius or not.

**47 (§ 34) the description, begun here, of the preliminaries to an intellectual adventure: my own**

Let us use a metaphor – A far-off pole, difficult to attain – The aim of the adventure – **Project** with its shadow, a novel – I did not write this novel – Having set about recounting this journey.

**48 (§ 34) Pierre would at once make several further, instantaneous leaps; upon which he used to seize upon the reasoning of others, just as their sentences were being born, and finish these first**

We live in the future perfect – This sense of the present has other ways of manifesting itself – I shall provide four examples: Jean Queval, of the Oulipo – Guy Harnois – Florence – My mother.

**49 (§ 35) his inability to submit to the strict rules of painstaking proof prevented him from attaining scientific glory**

For a long time, I thought that he was a mathematician from another era – There were, under certain conditions, ways to make good this lack – Separates once and for all the wheat from the chaff – Just as hierarchical and rigid – Pierre had taken on board this judgment – All of this is quite probable.

## Bifurcation A: The Great Currents of President Le Lionnais

### 50 (§ 6) **it was a sudden idea, an exhilarating, overwhelming, illuminating idea**

The idea of acquiring an understanding of the world – It affirms its own veracity – I must now go back a few years – I shall go into further detail about this fortuitous encounter – Given my age at the time – It was a year of semi-relaxation – I was really looking forward to going to Paris – This large issue of *Les Cahiers du Sud* – The notion of the *transfinite*.

### 51 **the eyes of the pupils and teachers of my school were turned towards glorious tomorrows**

Eyes focused on the “blue line of the Vosges” – Numeric infinity (that umbilical limbo) – An aleph, the first member of the Cantorian family – I cannot have understood a great deal – We will get to know its author better – Description – Circumstances – Deportation to Dora – A chess handbook for one of the warders.

### 52 **“Among the hopes that sustained him,” Ballard went on**

Some of the names, which were written on a piece of packing paper – Having written on Third Reich paper with a Nazi pencil – A “cover” for his activity in the Resistance – Painting in Dora – An experiment played out in the theater of memory – Why this preamble? – The first pointers – Investigations.

### 53 **Description of The Great Currents of Mathematical Thought: second moment**

The start of an infinite series – The residue of the initial project – Forever

seeking out the future – What can be seen behind these allusions? – Put off to a date even further in the future – Not to mention its massive bulk – Hilbert's hotel.

#### **54 Those who knew President Le Lionnais will no doubt experience a certain feeling of déjà vu on reading this**

In that extraordinary man's career – This notion is close to me – An overall impression of making-do – Disparity—the word has now been used – He had planned to publish his Memoirs under this title – The corollary of this existential “theorem” – Particularly discouraging – A second volume, then a third et cetera – *Le or la disparate*.

#### **55 (third moment): of two Franco-French generations.**

An examination of the contents – Cohabitation (and discordant clash) – From before the First World War: they had lived through that massacre – I was one of their pupils, but only just – There was also Hadamard, then almost a hundred – We watched him with tenderness – Two members of the Resistance who died after deportation – The seat of honor was reserved for the avant-garde – Henri Cartan, the pedagogical cement.

#### **56 The Gr.C. and Bourbaki**

Insolent, badly brought-up terrorists – Who shall remain nameless (André Weil) – These disputes which always remained quite discreet – The very structure of the book – The part of the book, entitled ‘Epic’ – Two members of the group in this section – Homage to David Hilbert – Nod towards old Borel – A real first.

### 57 **This text deserves particular attention.**

Bludgeons of quite Neanderthal proportions – The most flagrant meta-physical snares – The Haussman-like dream of Bourbaki – Closely comparable with Wittgenstein – The inimitable ‘tone’ of the group’s works – ‘Mystery style’ – Eric Temple Bell – How marvelous the future was – Goldbach’s Conjecture.

### 58 **Then, plunged for a long time into “real” mathematics, I forgot about the Gr.C.**

And I met FLL – The far cooler perspective of this prose – FLL and Que-neau admired – The keen eye of a collector – He wanted to know, and he knew – Japanese algebraists – His conversation was digressive – Almost finished – Even more pressing projects.

### 59 **Description of The Great Currents of Mathematical Thought: final moments – André Weil and mathematical ethics**

Quite an astonishing text – The place of modern algebraic geometry – Mathematicians’ morals in the modern era – “While such science currently . . .” – “It is certain that few men” – A demand for independence – “Let the others haunt the antechambers” – A classic example of denial – Even in prison.

### 60 **Logic is healthy for mathematicians**

Not something that merits the slightest attention – A large degree of scorn – One of the blind points – Prophylactic, categories, computers – Distinct sciences – Passion for intolerance – A shotgun salesman’s universal ideas – All mathematicians are young – There are no secondary researchers.



**61 These ideas clearly indicate an elitist conception of talent (the theory of a “gift”), but they are not necessarily where such a conception must lead**

Not distance myself – Their own kind of absurdity – Dieudonné putting himself “at the service” of Grothendieck – How old was the inventor of the zero? – Progress cannot be made without a mathematical community – As he draws close to the peroration – “If, like Panurge” – The honor of the human spirit – Reaching the heights of the Himalayas in a bikini.

**62 The Great Currents fascinate me today, seen as the sketched outline of a literary genre**

Rather a distinct position – The opposite of Irving Goffman’s axiom – Coexistence of the underlying structure and design – A hasty juxtaposition of notes – “The cycloid, that beautiful Helen of geometry” – A fragment in a collection of fragments – Jacques Peletier du Mans – His “oblique” reasons.

**63 At such moments, you are not sorry to be reading it**

The missed opportunities – A genuinely aesthetic position, trying to find a form of expression – Fashionable mathematical engravings – In his house in Boulogne-Billancourt – Personal encyclopedic project – The limitations of one body – Cat; almost a living being; library – Head weighed down, like a stag by its horns.

**Chapter 3 (story): Neighborhood Filter**

**64 To begin at the beginning, of course; but which beginning?**

I needed the illusion of an absolute beginning – I was gripped by the

vertigo of a beginning – The mathematical beginning – This demon of beginnings – *Nevertheless, it is directed especially* – I had these four pages by heart – I would start with the first part – A particularly flagrant example of the paradox of beginnings.

#### 65 It was quite clearly impossible for me to begin in such a disappointing way,

The subject was not totally new – A pleonasm of insistence – This internally rigorous attitude – Between a passionate and utterly gratuitous activity – I had arrived at the material end of all possible vacillation – I made a compromise with myself – Close enough to doctrinal purity – This is what I ended up doing – Once again, at the end of 1954.

#### 66 Introduction to “Deductive Landscapes”.

Elements of a Science of Place – Horizon, reading, visibility, contemplation – The “mutual memory” of two details – Some preassigned strictly future instant – Such remembered landscapes in a subsequent chapter – We have not succeeded in freeing ourselves from time – A legible or moralized landscape – The choice of evidences – The earlier (and synonymous) name of dramaturgy.

#### 67 Keeping the general, solemn tone of the original

Quite a simple Oulipian technique – The invisibility one of its components – The intention of the poem – The transposition could be pursued – A “meta-aspect” – An image of the entire project in its unfinished state – A subsequent chapter in the narrative section of this branch – Absolutely no recollection – I cannot imagine how I could have decided any differently.

## **68 The moment of this narrative encounters the moment of this narrative**

Like a photographic image – The meeting between Uncle Emile and the Eiffel Tower – Co-presence – The moment I started reading – Identification of inner states is contingent – I would be incapable of choosing which direction – I shall begin by describing the first – The damp and misty Orkneys – Head full of shadows.

## **69 A September rain rains on the courtyard of the Sorbonne.**

I go through the special entrance – An old, threatened right – But, you might say, would it not be better? – Law of the good neighbor – Coincidences are not entirely random – I have often left again with other titles – This will be the twenty-fourth fall – Some Slavic scholar with bushy eyebrows – A “concordance” to Shakespeare’s works.

## **70 When I convoke the inner memory-image of the reading room in the library of the Sorbonne,**

The enchanting world – The room was open until ten o’clock – I went there secretly – The feeling of strangeness – A secret place was essential – I had added a layer to my camouflage – I was one of the last to leave the library – On the opposite platform – Despite all my efforts of unspoken persuasion.

## **71 I sat down in the reading room beside the windows**

When I arrived quite early – The first thing that strikes me today – To reach the first words of the actual text – This downhill slalom for the eyes – DEFINITION – All of the “necessary precision” – I read, with reverence – I read and reread these definitions countless times – Then there was poetry.

**72 It took me a long time, a very long time, before I admitted to myself that my reading would not progress**

Refusing the curiosity of anticipation – I copied it out, page after page – The greatest possible distance from poetry – The advice to the reader had warned me – Nothing in mathematics was intrinsically incomprehensible – A particular perspective – It concerns only tangentially – The indirect influence of Bourbaki, deflected from its actual purpose – This event.

**73 The title I have given to this chapter, Neighborhood Filter,**

Very general, albeit fundamental, notions – The introduction of **filters** by H. Cartan – To paraphrase Bishop Butler – It was impossible not to see these filters – The general slow rate of percolation – The image then becomes amplified – The most perfect of these singular beings – This image for me it has completely replaced it – Divine and singular ultra-filters.

**74 The image of the geometric point had changed in the inner space of my memory-imagination**

A sheet of paper which was itself almost perfect – A set of points distributed along a huge, infinite line – A “continuum” – So-called real space, whose name is **R** – The separation axioms – Accessible spaces – A neighborhood of one point of the pair that does not contain the other – Sitting in my place – It was there that, prudently.

**Interpolations in Chapter 3**

**75 (§ 64) the paradox of conviction, better known to logicians as Lewis Carroll's paradox**

*What the Tortoise said to Achilles* – How the Tortoise Fought Achilles – Scene 0, or prologue – Act I – Tea for two – I’m the bubbly Achilles.

## 76 (§ 75 continued, part 1) **Act II**

I don’t want to put you off . . . – I am the champion – We shall see what we shall see – Sophistry! Sophistry! – *Choking with fury* – This lettuce is delicious.

## 77 (§ 75 continued, part 2) **Act III**

I feel sorry for you – Just a minor formality – **(A) If Achilles is the champion of swiftness, and the Tortoise of slowness, Achilles will win the race** – I didn’t know that the ancient Greeks invented rugby – There was perhaps a tinge of sadness in his voice – Scene 00.

## 78 (§ 64) **its “Summary of Results,” which contained various definitions and propositions without the slightest proof**

The majestic temple dedicated to the goddess Mathematics – The trench for the foundations – Never step beyond a strictly axiomatic viewpoint – When publishing on the eve of the Second World War in 1939 – The construction of a metamathematical porch – The “naïve” point of view.

## 79 (§ 78 continued) **The reader had to wait fifteen years**

Of course, in the meantime, there was the war - People were waiting for this opportunity – The “formalized mathematics” declared as being “indispensable” – This unenthusiastic volume – Because of the clogging-up produced by its terribly slow techniques – An oddly embarrassed tone.

## 80 (§ 79 continued) **But the question of certitude had still not been resolved**

The question of certitude – The use of ordinary language – “See what I mean? Now you’re worried too!” – The Teutonic Knight of Mathematics – With distinct relief – Some will say that this is small comfort; but already for two thousand five hundred years . . .

**81 (§ 77) if it was true that a Japanese mathematician had just claimed that he had virtually proved Fermat’s Great Theorem, as one of his colleagues had read in *The Times***

Situating chronologically this moment – To attract my readers’ attention – It was on the morning of June 24<sup>th</sup> of the present year – I bought *The Guardian* –  $x^n + y^n = z^n$  – THE FINAL FRONTIER.

**82 (§ 81 continued) A little before ten thirty, yesterday morning,**

Andrew Wiles of Princeton University – The homothetic photograph (in a fractional relationship of modesty) – The Isaac Newton Institute of Cambridge – As Wiles’s words tumbled into all those mathematical ears – Bus number 27 was driving alongside the Police Prefecture – I started calling.

**83 (§ 69) when going from one to the other, from A to B, you went through a room mainly inhabited by Russian books**

A library is a territory – A classification number is like a street – I have acquired a geographical vision – The countryside constantly changes – The awkward stairs I climb to get to them – Its old quarters, its treasures and ancient monuments.

**84 (§ 70) I do not read the same things in different sorts of places**



A division of reading labor – This baseless prohibition – A narrative implies time – I had succeeded in making quite a clear division – Prose on the computer screen – For poetry, I need my hand.

**85 (§ 70) her violet rays, the alpha and omega of my desire, which she dispensed so generously to all the world's indifferent objects**

To say that all I desired was for her to return my gaze – I could see myself speaking to her – We would have left the metro rapidly – Self-propagating details – The luxurious point of arrival – In a way, my reward.

**86 (§ 85) the precision of her uninterest proved her interest; my dreams were born from such reasoning**

An obvious point completely escaped me at the time – I had chosen to wait on the platform – This troubling young lady, with eyes of marine iodine – Her refusal to grant me for even one second – Her evasive strategy – Things are perhaps best this way.

**87 (§ 71) I read and reread these definitions countless times, without understanding anything, literally without understanding anything**

A clear recollection of this incomprehension – My former self in that very place so vividly – I can see its pages – The many and obvious differences – Arguing with myself – In consequence, I say to myself.

**88 (§ 72) mathematics could be paraphrased (and is the thing that can perhaps be paraphrased most easily, even with certainty), and as such was situated at the greatest possible distance from poetry**

The things that can be paraphrased in mathematics – To try and reduce the ever-widening gap – This work of paraphrasing – With an unforeseeable side – Poetry is, always, future – To be placed as far away as possible away from poetry.

**89 (§ 72) Subsequently, I was to encounter no more insurmountable problems when reading a volume of the Treatise, including the exercises**

Including those marked with their redoubtable “flag” – Homage to Jean Dieudonné – The Dussane room of the ENS – Schwartz spoke, and spoke – During the war . . . – The finest moment of the evening.

**90 (§ 73) I can at once see something like an icon of topological space, a kind of broad grassland of “points,” each positioned above a filter-cup**

With its flat face – The “points” are then pure coffee beans – So, why grass then? – A unicorn comes to drink from the cups – As black as Chernozem coffee – But what can I do?

**91 (§ 73) The most perfect of these singular beings were those that “converged toward a limit”**

Such were the neighborhood filters – Two or more distinct cups – Farthest from the ordinary situation – The scenario becomes increasingly Carrollian – The fantasy world thus created – After all these gymnastics.

**92 (§ 74) All of this was beautiful, strange, and dazzling; it dazzled me; yet it did not satisfy me**

Small-minded – Space, imbibed with time – The infinitely thin frontier of our skin – To think about the field of memory in such terms – Two temporal dimensions of before and after – I am possessed by a personal Zeno.

**93 (§ 74) This is, I think, what happens in the memory, when one tries with difficulty to separate different recollections**

Thinking about the topology of inner time – A strange reversibility – A place in time which is always in fact imprecise – But if, on the contrary – There is always an overlapping – A minimal access to a rereading of the past.

**Bifurcation B: *Marginis Exiguitas***

**94 (§ 82) After these phone calls, I felt a little calmer.**

“*Cubum in duos cubos . . .*” – Which this margin is too narrow to contain – It can only be wondered who Fermat intended this remark for – This most insolent of “theorems” – “That the Ancients did not know everything” – Everyone also thinks that they know the “idea” behind Fermat’s idea – Now, this method of “infinite descent” – A “quantum leap” of difficulty.

**95 I used to know one mathematician who did not agree with this.**

A Minkowskian space which resembles the outside world – That Fermat could well have had an “elementary” proof – He grabbed his white napkin and produced a pen – His appearance was extremely striking – He spoke with an accent – His absentmindedness was legendary – He

always arrived at the seminar late – The door opened as usual, Krasner came in – He had a great interest in the theorem.

### **96 The deep-seated conviction that Fermat could not have had a proof of his theorem**

This bifurcation – While commenting on his theory, Kummer – Analogous to a chemical composition – Fluorine – Kummer went on – “The numbers we have here designated as reagents” – Kummer is also attributed with a slighting remark – Ideal complex numbers – The first Bernoulli numbers.

### **97 After sharing my emotion over the phone with everyone I had succeeded in reaching**

“Ah! If only François Le Lionnais had seen this day!” – I had another reason – I immediately made a provisional decision – The disappearance of this “terra incognita” – We would be robbed of an easy subject of conversation – When he called me the next morning, Jean Bénabou – The English mathematician L.J. Mordell – Assimilated by the specialists – Should this fact appear natural, sublime?

### **98 However, I did make a provisional decision**

I would try to understand – Pointless, at my age – The articulation of the ideas – The rebirth of the idea of “infinite descent” – At the time of writing this – I realized – Being retired from mathematics – So why not readopt? – I know that I shall not go through with my intention.

## **Chapter 4: Zero Point**

### **99 August is beginning and it is hot**

August, the month of climatic excesses – My solitary room at once adopts

the outside temperature – I have never liked Paris – From time to time, I imagine myself living elsewhere – I stay in Paris, obstinately – This is not part of my story – The attentive reader will not fail to recall – I am experiencing the greatest difficulty in placing even one mental toe – What will happen now?

### **100 The “second class club facilities” on the “base” were in a corrugated iron shack**

Placed directly on the sand – There was a choice between just two types of liquid – Very occasionally, a “non com” could be seen – The “rookies” were most drawn by the ephemeral coolness – The “veterans” – According to my calculations, were consumed – Always a crowd – “Transistors” were stuck against ears – I would sit down every evening in the sand.

### **101 The sand was everywhere. You saw sand, you breathed sand.**

You ate sand, and drank sand – By evaluating this sand, grain by grain – Reluctant to leave me – Three types of men on the base – Lying on my camp bed – Idyllic existence – From the hinterland of the Morbihan – Contemplating, on their arrival – What were they doing there?

### **102 The heat, even early on in the day, was intense.**

Hot – It rained – I did not suffer from the heat – Appeared from nowhere – PLBTs – Primitive mentalities – Linguistic artifact – Should they be considered as being even lower than second-class soldiers? – Gyrovagues.

### **103 Once, in the office, I had a whole day of comfort in front of me**

Arithmetical duties, bridge duty – Distributors of water – EGA – Grothendieck – Immersed in Bourbakism – The Dieudonné locomotive – The idea of Schemes – Radical upheaval – New route, damned route.

#### **104 France had decided to “get the bomb”**

Required experimentation – A “launch window” was established – Just one snag; the direction of the wind – The physical-chemical nature of the cloud – A detachment of our glorious army – An immutable ritual – The winds turned against us – No sympathy for atomic weapons – Curious.

#### **105 Apart from the rather rudimentary calculations called for in our work forecasting fallout,**

The American army’s viewpoint – Each series of data and each graph – Series of images – I remember a passage – One of those early mornings – The colonel made no mention of this – The great day – The Temptation of the Zero Point – A memorable scene.







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IAN MONK became a member of the Oulipo in 1998. His books include *Family Archaeology* and *Writings for the Oulipo*.











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