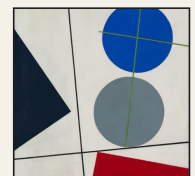
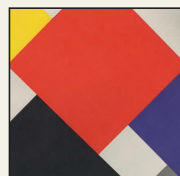
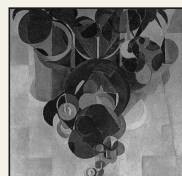
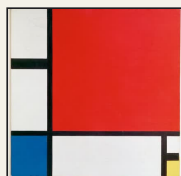

THE FIELD



An essay in seven chapters on the grid: invented as a metaphysics, employed as an administration, and here composed as a generator.



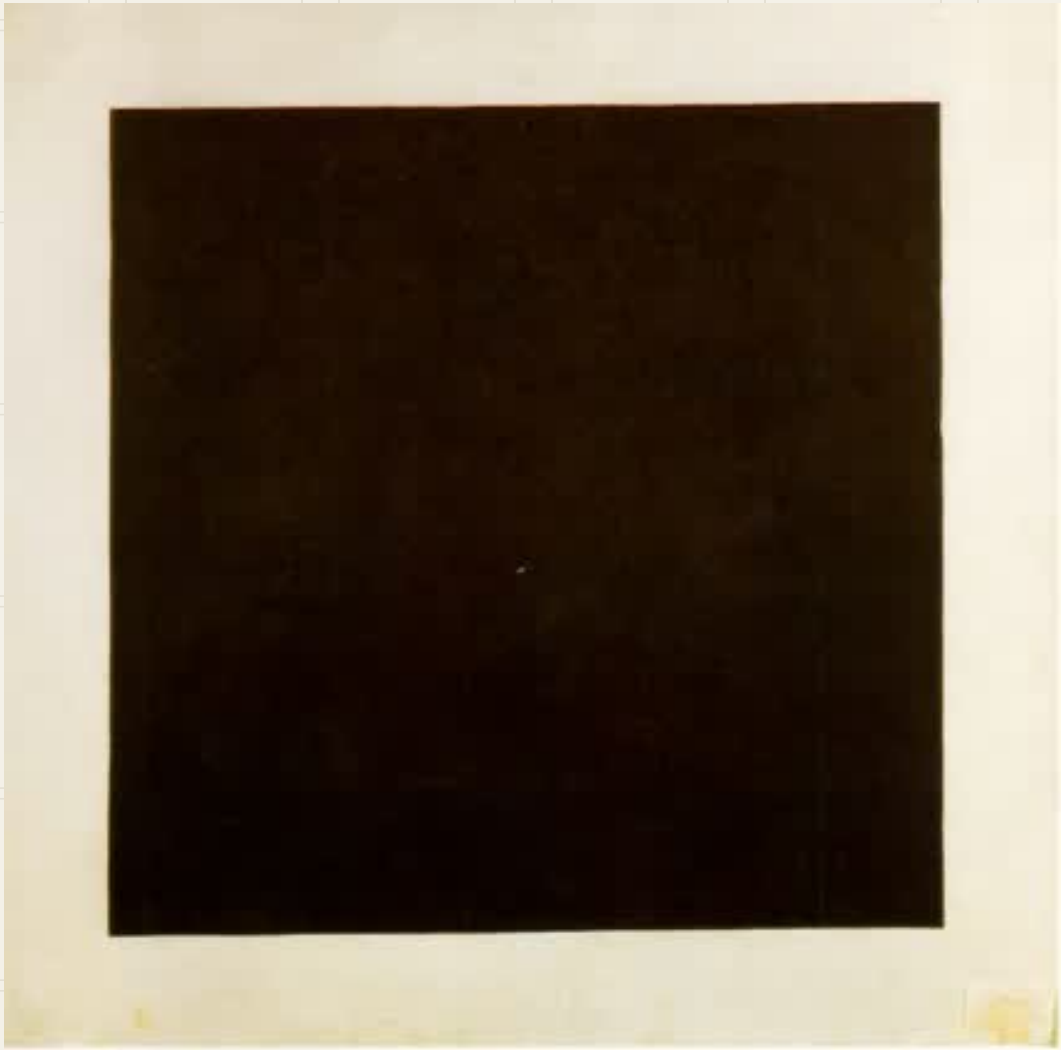


Plate 3. Petrograd, 1915. The rectangle stops being the window and becomes the view.



Plate 1. The quad prints as nothing, and everything in the line depends on its width being exact.

I. THE QUAD

The em quad is a piece of metal you can hold, and it says nothing. It carries no letter, no mark, no face at all. Cast to the exact square of the type size, as wide as the body is tall, it exists to occupy space and then to be locked away where the space it occupies will print as nothing.

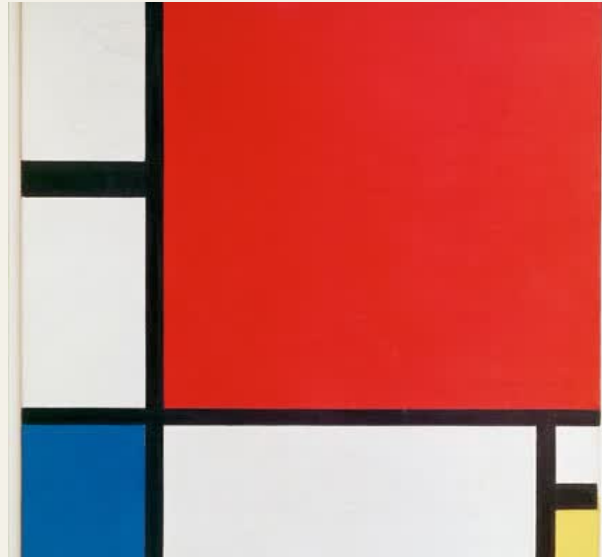


Plate 4. Horizontal, vertical, and the intervals between them: a decision about where the lines fall.

Consider what such a piece must be true to. It cannot be roughly square. It cannot be the right shape at one size and a little off at another. It has to be square to the body of the face it accompanies, because it will sit shoulder to shoulder with letters in a line that is locked up under pressure and printed under more, and any slack anywhere in that line is slack everywhere. Blankness, it turns out, is the most demanding thing in the case. A letter

A unit is the condition under which anything can be composed with anything.

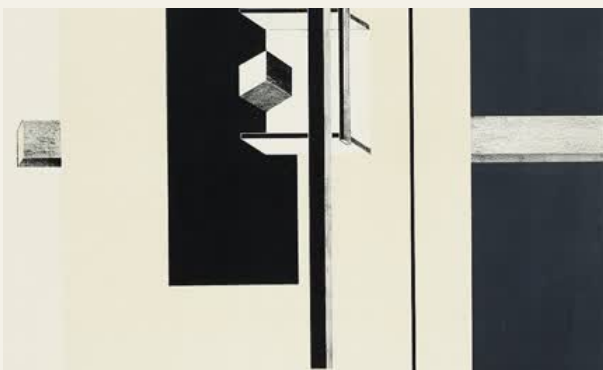


Plate 2. From the sort to the line, the line to the column, the column to the set of pages a book could legally be.

The Germans call it the Geviert, from *vieren*, to make four, and the name is honest: it is a made square, a manufactured absence. Every other sort in the case is chosen for what it will show. The quad is chosen for what it will hold open. It is the first object in this book because it is the first place where a designer commits to measuring emptiness instead of merely leaving it.

can be a touch imperfect and still read. A space that is the wrong width throws off the fit of everything around it, and the error does not stay local; it travels down the line and up the page (Plate 1).

That demand is what the point system answered. Before there was a fixed unit for the type body, a founder's metal was true only to itself, and a line built from two founders' sorts was a negotiation that usually failed. Didot's system did something quietly enormous: it fixed the body to a unit, so that pieces cast in different shops, by different hands, in different years, would stand the same height and lock up in the same line. The point is not a measure of how a letter looks. It is a measure of the metal the letter rides on. Standardise the metal and you have standardised nothing about the design and everything about whether designs can be combined at all.

Here is the turn on which the rest of the book depends, and it is worth stating plainly because almost everyone gets it backwards. A unit looks like a restriction on what you are allowed to say. It is the opposite. The unit is the condition under which anything can be composed with anything. Without a shared body, an italic from one foundry and a roman from another are simply incompatible objects, and no amount of taste will make them share a line. Give them a common measure and they combine freely, in orders no one anticipated, including orders their makers would have found ugly. Constraint here is not the wall around the field. It is the ground that makes the field a field, a surface flat enough that unrelated things can be set on it and still stand level.

Notice that the unit is measured, not chosen. This is the quiet scandal of the quad and it will recur at every scale in these pages. You do not decide that the em is pleasing; you derive it from the size of the face, and then you are bound by it. The designer's freedom begins one level up, in what is placed on the measured ground, and it is a larger freedom precisely because the ground beneath it does not wobble. A great deal of the argument to come is only this observation, pushed from the single sort to the line, from the line to the column, from the column to the page, and at last from the page to the entire set of pages a book could legally be (Plate 2).

For if a line is built from a fixed body, and a column from a whole number of lines, and a page from a small vocabulary of columns and pictures that must each sit true, then the pages a book can be are not infinite. They are many, they are more than a person could ever picture, but they are countable, and a countable thing can be searched, scored, and drawn from. That is the whole of what follows, and I will not press it here.

make. Larger, because it proposes that geometry is not a way of organising a subject but is itself the subject, and that the flat right-angled field can carry a claim about how the world is put together. Malevich called the system Suprematism, and whatever the word was meant to supremacise, the operative fact for everything that followed is this: after 1915 the rectangle could be held up as a thing believed rather than a thing used. The distinction never fully dissolved again.

The belief spread laterally and fast, which is the way beliefs move when the object carrying them is easy to reproduce. In the Netherlands, Theo van Doesburg founded the journal *De Stijl* in 1917, and a journal is the correct vehicle here, because the claim was portable, printable, and better argued in a run of pages than in a single canvas. Piet Mondrian worked the same reduction toward its floor: horizontal, vertical, and the intervals between them, until a painting was a decision about where the lines fall and how much air each field is granted. The right angle was not a compositional preference. It was presented, in the prose these men wrote around the

The rectangle went to work, and it took its convictions with it.



Plate 5. Two squares cross a world of smaller shapes. A reduced vocabulary, carrying a sequence.

The grid was invented as a metaphysics, when a rectangle stopped being a box for holding things and became an argument about the world. It was invented again as an administration, when postwar Zurich turned that argument into a method for handling information cleanly and neutrally and the same way twice. This book proposes it a third time, as a generator: not a way to arrange objects on a page, but a way to enumerate the pages themselves and let a machine, given a seed, hand you one. All three inventions begin with the same small square of metal that does nothing but hold its place, exactly, forever.

II. THE RECTANGLE AS AN ARGUMENT

The rectangle is the most literal object in art. It has four sides and does nothing. This is precisely why the generation that inherited it around 1915 could load it with so much weight: a shape that refuses to depict is free to assert. When Kazimir Malevich hung his Black Square high in the corner of a room in Petrograd, in the exhibition remembered as 0,10, he was not framing a scene. He had taken the rectangle that until then had been the picture's polite boundary, the window through which one looked at something else, and made it the entire content. There was nothing behind it to look at. The edge was the argument (Plate 3).

This is a smaller gesture than it sounds and a larger one than it looks. Smaller, because a black quadrilateral on a white ground is not difficult to



Plate 6. Overlaid planes with the frank flatness of a printed thing.

pictures, as truer than the diagonal, truer than the curve, closer to some order the eye had been failing to see (Plate 4).

One should be careful not to convert their sentences into their souls. What the work shows is narrow and it is enough: an insistence that horizontal and vertical are not neutral, that the grid of the plane is a position and not a default. Whether Mondrian was calm or anguished at the easel is not on the canvas and is not our business. What is on the canvas is that a line meeting another line at ninety degrees was made to mean, and was defended as meaning, and was published as meaning. That defence is the inheritance. The grid did not arrive in the printing trade as a labour-saving convenience that later acquired airs. It arrived already convinced of itself.

The most instructive figure for a book about pages is El Lissitzky, because he did the thing that the others mostly implied: he moved the rectangle onto the page and let it act. His Proun works treat the flat sheet as a construction site, forms that seem to have weight and address, arranged as if they were about to be built rather than merely looked at. And in 1922 he made *Of Two Squares*, a book for children in which two squares, a black one and a red one, cross space and rearrange a world of smaller shapes (Plate 5). It is propaganda, it is a picture book, and it is a design manual disguised as both, because it demonstrates that the same reduced vocabulary that hung in the gallery corner could carry a sequence, a before and after, a page turn.

That last point is the one the trade would eventually collect on. A painting asserts once. A book asserts in order, spread after spread, and a shape that means something in isolation begins, when repeated across pages under a governing angle, to mean something structural: that these elements belong to one system, that the system was decided in advance, that the reader is inside a rule and not a whim. Lissitzky's squares do not illustrate a story so much as enact a grammar, and a grammar is exactly what a grid is. The distance from *Of Two Squares* to a modular page plan is short, and it is a distance of degree, not of kind.

The reduction was not the property of a single country or a single manifesto, and it is worth resisting the tidy version in which four or five men own the idea. Sophie Taeuber-Arp was building compositions out of squared fields and measured intervals, work in which the grid is not a scaffold hidden under an image but is the image, the unit of colour and the unit of space made identical. Lyubov Popova, working out of the Russian avant-garde alongside the Suprematists, treated the picture as a set of



Plate 8. Not a look but a jurisdiction: a set of places where things are allowed to be.

overlaid planes with the frank flatness of a printed thing (Plate 6). The right angle, in other words, was being argued in several rooms at once, by people who did not all agree about why, which is usually the sign that an idea has stopped being an opinion and started being an environment.

It matters that almost none of this was designing layouts. There was no client, no fold, no column of body copy to be poured. These were paintings and manifestos and one small book, made by people who believed, and said in print that they believed, that the perpendicular was a claim about reality. The consequence for graphic design is a kind of accident of inheritance. When the discipline later reached for the grid as a way to arrange text and pictures, the tool it picked up had been forged as a metaphysics and had never been demagnetised. It came with the conviction still attached: that order is not merely convenient but correct, that the vertical and the horizontal are not a habit but a truth, that to align is to be honest and to tilt is to lie a little.

This is why the grid, in every later argument about it, is discussed in a moral register that no other production tool attracts. Nobody accuses a spellchecker of authoritarianism or praises a margin for its integrity. The grid gets both, routinely, because it arrived carrying the beliefs of people who were not thinking about margins at all. The rectangle that Malevich hung in the corner did not stay in the gallery. It went to work, and it took its convictions with it, and every clean modular page since has been in some quiet way a continuation of the claim that a right angle is not nothing.

The useful thing to hold onto, going forward, is that the metaphysics is real and also detachable. One can accept the whole apparatus of the grid, its perpendiculars and its measured intervals and its refusal of the diagonal, without signing the manifesto that first justified it. The postwar designers would do exactly that: keep the geometry, quietly drop the cosmology, and turn a claim about the world into a method for handling information. But the moral residue does not fully wash out, and that is not a flaw to be corrected. It is the reason the grid still feels like it means something when you obey it, and like a small transgression when you do not.

III. THE GRID BECOMES A JOB

The metaphysical rectangle, having announced itself as an argument about the world, needed a job, and it found one in the two cities where argument goes to become procedure. Postwar Zurich and Basel took the right angle down from the wall and set it to work handling information. The claim did not so much fade as get employed. What

Malevich had offered as a wager on the absolute, Zurich accepted as a filing system, and this is less a betrayal than a promotion: the rectangle that could mean everything was asked, at last, to mean something specific, on a deadline, at a printer's tolerances, for a client who needed a timetable read at a glance.

The house organ of this second invention was a journal, *Neue Grafik*, which ran from 1958 to 1965 under four editors, Josef Müller-Brockmann, Richard Paul Lohse, Hans Neuburg, and Carlo Vivarelli. The names matter because the enterprise was collective by design; the grid was not a private style but a public method, something one could hand to a colleague and expect back correctly used. A metaphysics has believers. An administration has staff. The move from the first to the second is exactly the move from a manifesto that must be argued to a specification that can be checked, and it is the specification, not the argument, that a working studio can actually run on (Plate 7).

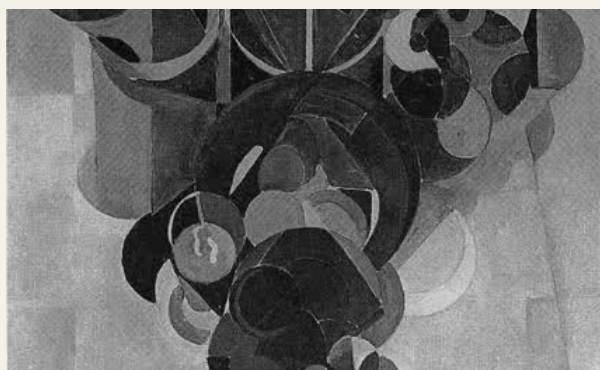


Plate 7. A metaphysics has believers; an administration has staff.

For the specification, read Müller-Brockmann's *Grid Systems in Graphic Design*, published by Niggli in 1981, and read it for what it is rather than what its reputation promises. It is not a manifesto. It is a manual, and its authority comes from the flatness of its assertions. The governing law is arithmetic: no half lines in typography, he says, every vertical distance a whole number of lines (pages 58 to 59, and again on 64). The page is quantised before a word is set. Everything downstream inherits that discreteness, which is the first hint, decades early, that a page built this way is a thing you could count rather than merely admire.

From the whole-line rule the rest descends as consequences, each stated with the calm of someone reporting a measured fact. The narrower the column, the smaller the typeface (page 57), because a face too large for its measure cannot make a decent line. Seven to ten words to a line (pages 30 to 31), which is the eye's comfortable reach and not a matter of taste. Eight to twelve point for the text of books (page 18). The width of a column of text decides the width of a picture set into it, the two matched exactly (page 63), so that the image does not float free of the text but is dimensioned by it. These are not preferences. They are engagements between quantities, and each one removes a degree of freedom from the page.

The rules go on, and their reach into the small decisions is the tell. A caption does not sit wherever it looks well; it belongs in the caption column beside the picture (pages 63, 87, and 120), a reserved lane, an address. Picture sizes should be few and graded, and one picture may be allowed to dominate the rest (pages 11 and 70), which is permission granted sparingly and by rule rather than by mood. The type area floats high on the sheet, its mass forbidden to sink (page 51). Lines may be set flush right and left, but never the last (page 80). The margin column stands at the outer edge (page 55). Read together they describe not a look but a jurisdiction, a set of places where things are allowed to be (Plate 8).

Now say plainly what is lost. What is lost is the wager. Malevich's square was a risk taken in public, a thing that might have meant nothing and staked everything on meaning all. By the time the same rectangle is deciding whether a caption may sit an eighth of an inch lower, the risk is gone, retired, converted into competence. The sublime does not survive contact with a caption column. Nobody stands before a well-set railway timetable and feels the floor drop away. The grid, employed, stops being an event and becomes a condition, present everywhere and remarked nowhere, which is precisely what an administration is for and precisely what a revelation cannot abide.

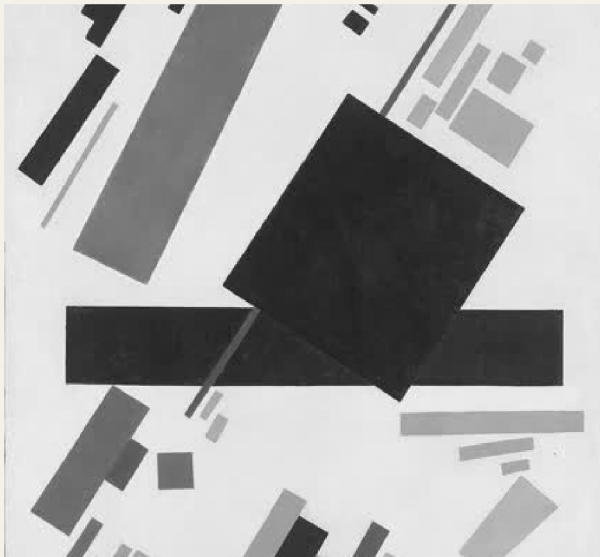


Plate 9. Drawn in red so it could be seen in the studio. The red vanished in the press.

And say plainly what is gained, because it is not small. What is gained is that the page becomes reliable, transmissible, and fast. A stranger can read the timetable. A second designer can finish the catalogue the first began and no seam will show. The exhibition panel can be built by measurement rather than by genius, which means it can be built at all, on time, by ordinary competent hands. Clarity stops being a gift certain talented people happen to possess and becomes a procedure anyone



Plate 11. Fifty-eight units: the least field that stays whole under all six divisions.

could be seen in the studio, plain against the black of the type, while the work was being made. Then the work went to press, and the red vanished. It was never meant to print. The apparatus that governed every measurement of the page, that decided the width of the column and therefore the size of the face and therefore the number of words the eye must cross, was itself invisible in the result, a structure present in every dimension and absent from every surface (Plate 9).

Fifty-eight is a proof. Nobody chose it.

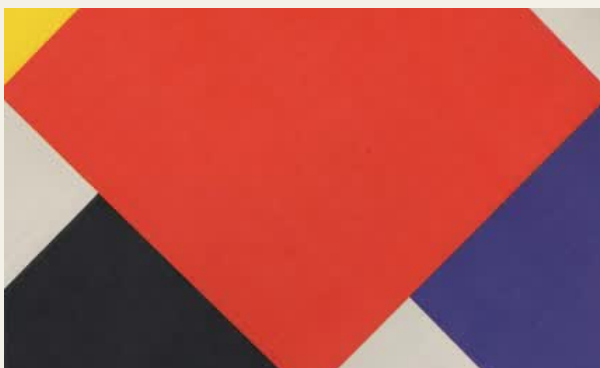


Plate 10. The morphological box does not depict a layout. It depicts the space of layouts.

disciplined can execute. The metaphysics kept the truth for the initiated. The administration ships it to the platform, the gallery wall, the printed catalogue, where a person in a hurry can use it.

There is a detail in the practice that holds the whole argument in miniature. Müller-Brockmann drew his grids in red, so that the scaffolding

This is the exact condition of an administration doing its job well: total influence, zero visibility. The red lines are the rules made briefly literal, ink you can point at, before they retreat back into being the reason the page looks inevitable rather than arranged. A reader of the finished sheet sees only rightness and cannot say why, because the why has been lifted out of the picture, the way the load-bearing wall is the one you never notice until it is gone. The grid became a job, and the mark of a job well done is that the labour cannot be found in the product.

Hold on to the arithmetic, though, because the book that follows depends on it. When Müller-Brockmann forbade the half line and insisted that every vertical distance be a whole number of lines, he was not only tidying the page. He was, without saying so and probably without intending it, making the page finite. A dimension that must be a whole number of lines cannot take infinitely many values; it can take this many, or that many, and no value between. Once every measurement on the sheet is a count of something, the sheet has stopped being a continuous field of possibility and become a discrete one. That is the door the third invention will walk through, and the administrators, drawing in red so they could see what they were doing, propped it open without ever looking through it.

IV. PROGRAMMES, NOT SOLUTIONS

Karl Gerstner published *Designing Programmes* in 1964, and its argument fits in a single inversion he never tired of repeating: instead of solutions for problems, programmes for solutions. The

sentence sounds like a slogan until you notice how much it gives up. A solution is a finished thing, a poster that exists, a page you can hold. A programme refuses to be that. It is the rule that would make the poster, held one step back from any particular poster, and it is content to describe a thousand it will never draw. Gerstner was asking a designer to stop delivering the object and start delivering the machine that stamps the object, which is a strange thing to sell a client, and a stranger thing to sell a discipline that had always been paid by the finished sheet.

The instrument he built for this is the morphological box, and it is worth being literal about what it is (Plate 10). Take every decision a design must make, list the options under each as a column, and set the columns side by side. Typeface here, weight there, size, measure, the position of the image, the direction of the reading. Each column is an axis; a design is one choice from each; the box is the product of all of them at once. The box does not depict a layout. It depicts the space of layouts, laid flat so that its inhabitants can be counted on the fingers rather than summoned by inspiration. What had been the private weather of taste became a grid of coordinates.

This is the move on which everything after it depends, so it is worth saying plainly what it costs the mystique of the field. Design had always described itself as choosing, and choosing had always been described as a gift: the eye that knows, the hand that finds. Gerstner's box does not deny the eye its work, but it relocates it. The eye no longer conjures the option out of nothing; the option is already there, sitting at row four of column two, one cell among its neighbours, waiting to be reached rather than invented. Enumeration replaces imagination as the thing that produces candidates. Imagination is demoted to the thing that judges them, which is honest, and a little deflating, and exactly right.

Consider what the box does to the word creative, which the trade uses to mean unbounded. A box with six columns of four options each contains four thousand and ninety-six designs, and not one of them is a surprise to the box, because the box contains them all before anyone looks. The surprise, if there is one, belongs to the designer who walks the cells and finds a neighbour she would never have summoned unprompted, sitting quietly next to one she would have. The combination she distrusted on principle is right there, indexed, undeniable. This is the first appearance in this book of its governing irony: a bounded space is not a smaller place to be creative, it is the only kind of place where the creativity can be a search instead of a séance.

The mobile grid is the same thought carried into measurement, and here Gerstner did something a mathematician would recognise (Plate 11). He wanted one square field that could be divided into two columns, or three, or four, or five, or six, and he wanted every one of those divisions to land on exact line-units, with a gutter of two units standing between the columns each time. Most sizes betray you: divide by three and you get a remainder, divide by five and the columns fall between the lines. Gerstner asked for the smallest field that keeps faith with every division from one through six at once, and the answer is fifty-eight units. Fifty-eight is not a round number and was never meant to be pretty. It is a solution to a constraint, the least field that stays whole under all six cuts.

Sit with fifty-eight for a moment, because it is the whole book in one integer. Nobody chose it; it was found, and it was found because the constraints were stated precisely enough to have an answer. A designer working by feel would have picked sixty, because sixty is friendly, and sixty fails at five and at four in ways that only show up three weeks later at the press. The constraint did the choosing, and it chose better than the feeling would have, and it left behind a number that looks like a mistake and is in fact a proof. The grid stopped being a convenience for arranging things and became a small theorem about which arrangements are even possible.

Now hold in your mind what this actually required of the man, because it is the part that should unsettle you. Gerstner had, in 1964, the entire idea of generative design: a space of options declared in advance, a rule for combining them, a count of what the rule permits, a way to walk the count and select. He had, in other words, the specification of a program. What he did not have was anything to run it on. The four thousand and ninety-six designs of a modest box do not draw themselves when your output device is a pen. So he ran the program by hand. He laid the space out in ink, he worked the combinations across the paper, he enumerated with a nib a set that a later machine would enumerate in a blink, and he did it because there was, in the room, nothing else that could.

Do not read that as quaint. It is easy, from this side of the machines, to treat Gerstner as a charming forerunner who almost got there, a man waving from the far bank of a river we have since bridged. That is the wrong picture

and it patronises him into uselessness. He got there. The idea is complete in the box; the box lacks nothing but electricity (Plate 12). He was not reaching toward a method that was coming; he had the method, entire, and was executing it on the only processor available, which happened to be a human being with a straightedge and an unreasonable amount of patience. He is not a precursor. He is a programmer, and the accident of his birth date is that his hardware was ink.



Plate 12. The idea is complete in the box. The box lacks nothing but electricity.

There is a specific strangeness to imagine here, and the reader should be made to feel it rather than told about it. Picture a man at a drawing board treating his own hand as a slow computer, feeding it a space he has fully defined, and stepping the hand through combinations he already knows the count of, not to discover whether they exist, because he knows they exist, but simply because the space will not display itself any other way. Every stroke is the readout of a search he is performing with his wrist. He is not designing four thousand posters. He is printing, at the speed of a human arm, the contents of a set he had the wit to specify and not the machine to expand.

What Gerstner left, then, is not a style to be admired and filed under the year 1964. It is a search space, drawn by someone who understood it was a search space before there was any engine to search it with. The morphological box is a parameter space; the mobile grid is a constraint with an integer answer; between them they contain the claim the rest of this book will build on, that once a page can only be one of a countable number of legal pages, choosing a page is sampling, and sampling can be given to a machine. He drew the field. He simply had to be its processor too, in ink, by hand, because it would be some years yet before the field could be handed anything faster than a man.

V. THE LINE

The paragraph is where the grid stops being a diagram and starts being a decision. You have a column of a fixed width, a run of words that do not care about that width, and the problem of where to stop each line. The obvious method is the one a person would use with scissors: fill the first line until the next word will not fit, cut, move the surplus down, and repeat. This is called greedy, and the name is a diagnosis. It commits to each break at the first moment it can, having consulted nothing about what comes after. Every early line is comfortable. The cost is deferred, and the paragraph pays it at the end.

Watch where the greedy method fails and you learn something about all the methods in this book. The first two thirds read well because they are spending slack they did not earn; each line takes what it wants and leaves the remainder to the future. By the last third the future has arrived, holding a bill. A long word that would have sat quietly in line four, had line four been set a little tighter, is now stranded, and the lines around it are wrenched loose or jammed shut to accommodate a decision made paragraphs ago. The rivers of white open. The reader does not know why the bottom of the column feels nervous, only that it does (Plate 13).

Donald Knuth and Michael Plass named the fix in *Breaking Paragraphs into Lines*, published in *Software: Practice and Experience*, volume eleven, in 1981. Their move is the one the whole book keeps making. Do not minimise the badness of each line as it comes. Minimise the total badness of the paragraph, summed over every line at once, and choose the set of breaks that is best considered together. The consequence is a small act of generosity that a greedy method can never perform: a single line may be set loose, stretched a hair past its comfort, precisely so that the three lines

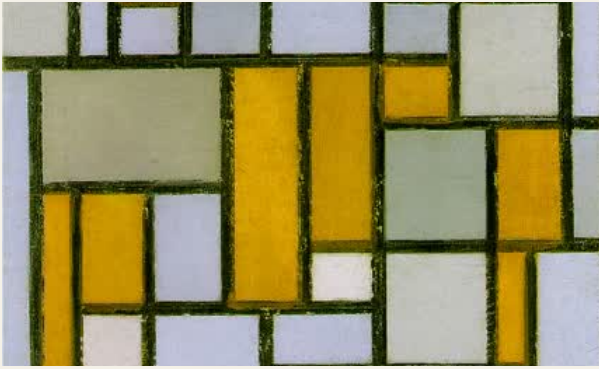


Plate 13. The greedy line spends slack it did not earn, and the last third pays the bill. after it can each be set well. One line agrees to look slightly worse so that the paragraph looks better.

This is a local optimum surrendered to a global one, which is the same shape of argument the grid itself makes about the page, and Gerstner's morphological box makes about the space of solutions. The line is the smallest room in which you can watch the trade happen. A break is not

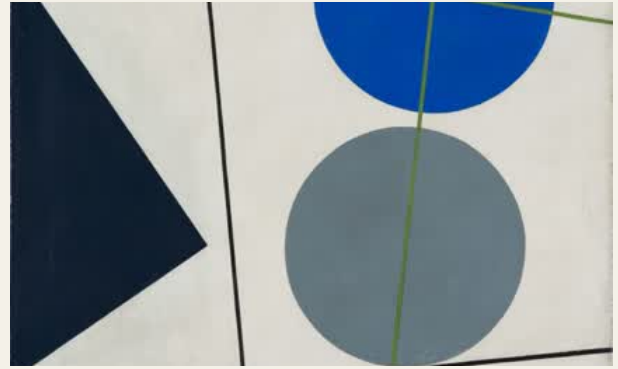


Plate 16. The caption lives in the row gutter, because that is the only place the grid made for it.

The optimiser needs somewhere to break, and English does not always oblige. A long word with no legal breakpoint is a wall the paragraph cannot get around, so it must sometimes be split, and the split must fall where the language permits and nowhere else. Franklin Mark Liang's 1983 Stanford dissertation gave TeX the instrument for this: not a dictionary of every word and its divisions, which would be enormous and would still fail on the

The last line is where the column concedes.

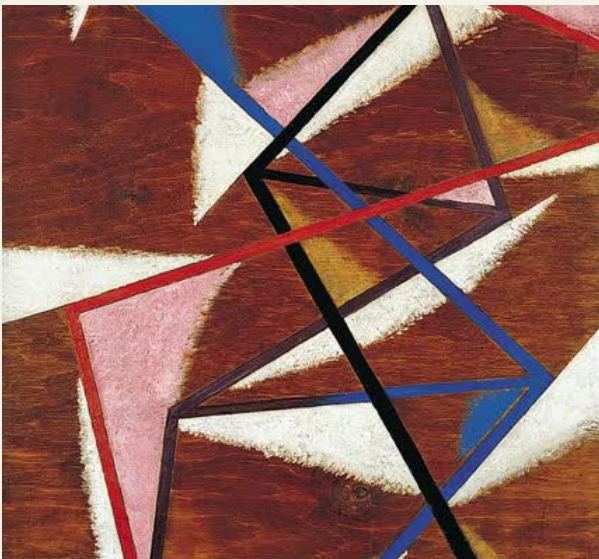


Plate 14. A paragraph does not end under tension. It ends by stopping.

good or bad on its own; it is good or bad in the company of the breaks that follow it, and the only way to know is to price the whole paragraph before you commit to any part of it. Knuth and Plass turned a row of scissors cuts into a single optimisation, and in doing so made the last third as calm as the first.



Plate 15. A picture is a rectangle of whole fields. Nothing else about it is expressible.

first word it had never met, but a compact table of patterns learned from a dictionary. The patterns generalise. They hyphenate words the table has never seen, correctly far more often than not, because they encode the habits of the language rather than its inventory. A small learned thing that behaves well on the unfamiliar is, again, the ambition of the entire library.

Then there is a rule that no optimiser will discover on its own, because it is not about cost but about meaning. Müller-Brockmann gives it on page 80: lines may be set flush right and left, justified to both edges of the column, but the last line of a paragraph never is. The reason is not decorative. A justified line is a line under tension, its spaces stretched until the words touch both walls, and a paragraph does not end under tension. It ends by stopping. The last line is allowed to fall short and sit flush left, its right side ragged, because that ragged edge is the visible fact of an ending. Stretch it to the margin and you have told the reader the thought continues when it does not (Plate 14).

So the last line is a special case in the grammar of the column, and the algorithm has to be told, not shown. It is the one line whose badness is not measured against the far margin, the one place where reaching the edge would be the error rather than the goal. Knuth and Plass build this in as a matter of course; the final line is set against a different standard, permitted its shortfall, scored as if the wall on the right were not there. The optimiser that would stretch every other line to both edges must be instructed to let this one go slack, because the paragraph's meaning lives in exactly the place the arithmetic would otherwise correct.

There is a wrinkle that Müller-Brockmann's book, printed once and holding still, never had to face, and that this library could not avoid. On a fixed page the measure is constant: every line in a column is the same width, so the optimiser solves one clean problem. But a picture may intrude on a column, and where its width matches the column beside it the text must flow around it, which means the measure changes from line to line. The lines beside the picture are short; the lines above and below run full. The paragraph is no longer a rectangle but a shape with a bite taken out of it, and a line breaker that assumes a single width will break it against a column that is not there.

The fix was to make Knuth and Plass grid-aware. The badness of a line is scored against the measure that actually applies to that line, read from the grid at the vertical position the line occupies, rather than against one width assumed for the whole paragraph. The optimiser still minimises total badness over every line together; it simply asks the grid how wide each line is allowed to be before it prices it. The last line keeps its exemption whatever width it inherits. The paragraph and the picture negotiate the column between them, and the breaks fall where the sum of the whole is best, bite and all.

Which is the honest way to describe what justification is. It is an argument between the words and the column about who is in charge. The words would run to whatever length they please; the column insists they arrive at both walls together, and stretches the spaces until they do. For most of the paragraph the column wins, and the words submit to the measure. The last line is where the column concedes: it lets the words stop where they were always going to stop, ragged and short, and admits that the ending belonged to them all along.

VI. WHAT CANNOT BE EXPRESSED

A position, in most systems that set type, is a number. You give the picture a top edge of one hundred and thirty-eight points and a left edge of ninety-one, and it goes there, obediently, wherever there happens to be. This is usually described as freedom, and it is, in the way that a blank cheque is money. The number can be anything. It can be the wrong thing. It can be a thing that is wrong by a quarter of a point, invisibly, so that the picture sits almost on the line of text beside it and the eye reads a mistake it cannot name. The system that offered you the number has no opinion about which numbers are good. It will place the picture at one hundred and thirty-eight as cheerfully as at the one correct value, because to the system they are both just coordinates.

The consequence is not that such a system makes wrong pages. The consequence is that it can express them. Every off-grid position is a sentence the system is willing to utter, and there are uncountably many of them, a smooth continuum of near-misses in which the small number of right answers is a scatter of isolated points. A machine that can say anything cannot tell you what to say. It has no way to prefer, because preference would require that some coordinates be unavailable, and in a world of numbers every coordinate is available. Infinite expressiveness and total ignorance turn out to be the same property seen from two sides.

Here a picture is not placed at a number. It is a rectangle of whole fields (Plate 15). It occupies three fields by two, or five by four, and its top edge is the top edge of a field because there is nowhere else for an edge to be. You cannot ask for one hundred and thirty-eight points of descent, not because a rule forbids it but because the request has no grammar. There

is no slot to type the number into. The illegal page is not prohibited; it is unsayable. This is a stronger thing than prohibition, and a quieter one. A prohibition admits that the forbidden act exists and posts a guard against it. Unsayability does not post a guard, because there is no act to guard against. You cannot break a rule you have no words for.

Follow the consequences down, because they are the whole argument. A picture is three fields tall. It is never one hundred and thirty-eight points tall, and the sentence "the picture is one hundred and thirty-eight points tall" is, in this system, not false but meaningless, the way a colour has no length. A caption does not float somewhere near its picture at a distance you nudge until it looks right; it lives in the row gutter, the band of white the grid already keeps between one field and the next, and it lives there because that is the only place the grid has made for it (Plate 16). A column of text is not a box you draw. It is a run of free field rows, one after another, the fields the pictures have not claimed, read downward until a picture interrupts and the run resumes below it.

And the widths agree, which is the part that looks like taste and is actually plumbing. The width of a picture matches the width of a column of text, because both are measured in the same fields, and Müller-Brockmann says so on page 63: the picture and the column are the same organ seen doing two jobs. This is why a page composed on the field looks composed even before anyone has arranged anything. The agreement is not achieved. It is unavoidable. A picture cannot be a width that no column is, because there is no such width to be. The band that opens below a captioned picture, the breath before the text starts again, does not grow by a soft handful of points; it grows in whole body lines, one line then two then three, each a discrete step, following the same page 64 that forbids the half line everywhere else in the book.

Notice what has quietly happened. We began by taking something away. We removed the number, the free coordinate, the ability to put the picture at one hundred and thirty-eight. The usual word for this is restriction, and the usual feeling is loss, the designer's cage. But count what is left. If a picture can only be a whole number of fields wide and tall, and can only begin at a field edge, and a page has some fixed number of fields, then the number of ways to lay pictures onto that page is not infinite. It is not even large in the way the continuum is large. It is finite. You can, in principle, list them. The unsayable page did not merely become forbidden; by becoming unsayable it fell out of the count entirely, and what remains is a set with a last member.

This is the reversal the whole book leans on, and it is worth saying slowly because it sounds like a trick and is not. A continuum cannot be searched. You cannot try all the positions between ninety and ninety-two points, because there is no all; between any two you name there is another, and the good ones are a measure-zero dust you will never land on by trying. A finite set can be searched. It can be counted, which means it has a size; it can be scored, which means its members can be ranked against the rules, against seven to ten words to a line, against the type area that floats high and the mass that may not sink; and it can be sampled, which means a seed can reach into it and pull out one page and then, given another seed, a different page, and both will be legal because illegal was never in the bag (Plate 17). The cage turned out to have a door, and the door was the bars.

An honest word about size, since the argument would be cheap without it. Finite is not the same as small. The count climbs quickly. A page of a few dozen fields with a handful of pictures already admits more arrangements than anyone would care to print, and as the grid grows the number grows past the point where listing them one by one is a thing you would ask a machine to finish. So the library does not, past a certain size, enumerate. It searches. It runs a beam over the pictures that come due on a page, keeping the strong partial layouts and dropping the weak ones, scoring as it goes, and a seed chooses among the good pages it finds. The distinction matters and I will not blur it: the space is finite, which is what makes search meaningful, but it is large, which is why the tool searches instead of counting.

What has been bought with the lost coordinate, then, is not perfection and not even completeness. It is countability, and countability is the precondition for everything the rest of this book will do. You cannot roll a die with infinitely many faces; the phrase describes nothing. You can roll a die with ten million faces, and you can make every face a legal page, and you can hand the same seed to the same die a year later and get the same page back, forever, because the faces do not move. The system that could express anything could be nudged and never chosen from. This system cannot express the wrong page, and so, for the first time, the right pages can be reached by reaching. Take away the number and you do not get less. You get a set you can finally put your hand into.



Plate 19. Taste is a small object of named weights. Someone chose those numbers.

VII. THE SEED

The grid was invented twice, and this book has spent six chapters arguing that the third invention was already latent in the first two, waiting for a machine patient enough to count. Here is the machine's account of itself, told plainly, because the argument only works if the mechanism is not hidden. When a page is due, the library does not

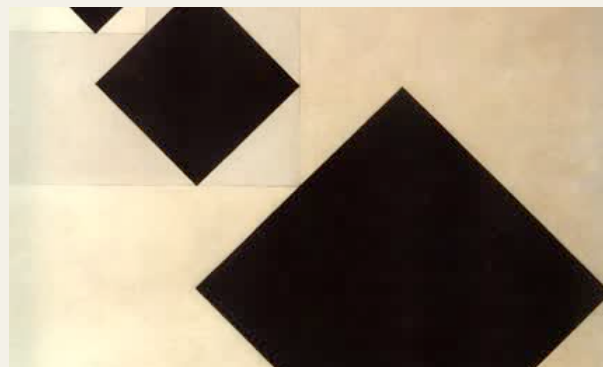


Plate 17. Illegal was never in the bag.

Each candidate page is scored, and the score is nothing more exotic than Müller-Brockmann read back as arithmetic. Few graded picture sizes, so a page that invents a seventh size is penalised. Edges that align, so a picture whose left runs off the column it should occupy loses points. One picture may dominate, so the composer is rewarded, sometimes, for letting a single image take the field and starving the others of it. Mass may not sink: the type area floats high, and a page that lets its weight settle toward the

A page that could be anything can only be nudged.



Plate 18. A beam keeps the strong partial pages alive and drops the rest.

arrange it. It searches for it. The pictures that come due on a given page, the ones the manuscript has scheduled to land there, are the fixed points; everything else is a move. The composer runs a beam search, keeping a handful of the best partial pages alive at each step and discarding the rest, which is how a countable but enormous space is walked without pretending to see all of it at once (Plate 18).

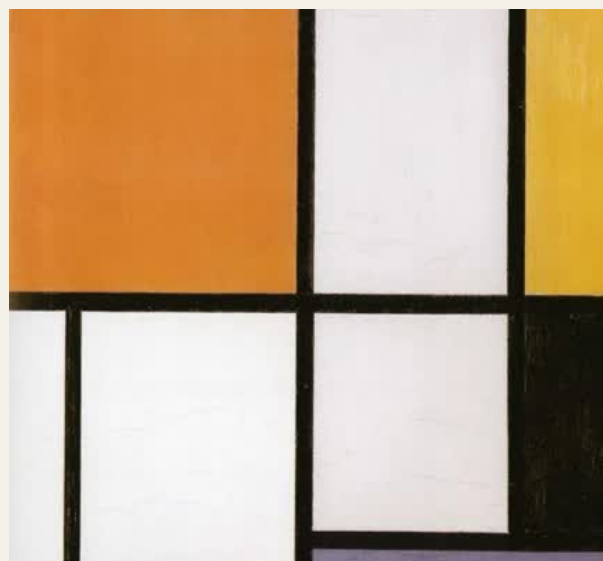


Plate 20. The grid did not narrow the field. It is the only reason there was a field to sample.

foot is marked down for the offence the 1981 book names on page fifty-one. The rules were written to be obeyed by a human hand in a studio. They turn out to be just as legible to a function that returns a number.

I want to be honest about the word search, because it is doing real work and not standing in for something grander. Once the pictures on a page

number more than a few, the set of legal arrangements is too large to enumerate in full, and the beam is exactly the admission of that. The library does not look at every good page. It looks at the ones its heuristic keeps alive long enough to finish, which means the composer has a taste, and taste can miss things. This is the difference between the promise of a countable space and the practice of sampling one. The space is finite; our walk across it is not exhaustive. A grid makes the pages countable. It does not make them few.

ago chose the space and the numbers and the seed, and then stood back. If you reroll it, change the integer on the back of your hand and ask again, you will get a different book, and it will be correct in exactly the same way this one is, obedient to the same red lines that vanished in the press. The grid did not narrow the field. It is the only reason there was a field to sample. That is all the third invention is, and it is enough.

Taste is a small object of named weights. Someone chose those numbers.

And the taste is not a mood. It is a small object of named weights, a dozen or so numbers that say how much a duplicated size costs against how much a dominant picture earns against how much a sunk mass is forgiven. You can open the object and read it. This is a confession as much as a design, because someone chose those numbers, and no amount of Swiss neutrality can launder the choosing (Plate 19). The postwar grid sold itself as the removal of the designer's hand, the page as pure administration. The generator cannot make that claim, and does not try to. It relocates the hand. The hand is now in the weights, and the weights have an author, and the author has, somewhere, decided that one picture dominating is worth precisely this much and not that.

Over all of it sits the seed. Give the composer a seed and it chooses, among the pages the beam judged good, one page, deterministically, and it will choose the same page for that seed until the arithmetic itself is changed. Same seed, same book, forever. This is the fact that makes the whole apparatus a work and not a service. A service gives you a different answer each time you ask and calls the difference helpfulness. A work gives you the same answer and calls the sameness its identity. The seed is small, an integer you could write on the back of your hand, and it names a single point in a space too large to hold in the mind, the way a catalogue number names a canvas nobody in the room has seen.

Here is the argument the book has been circling since its first rectangle, stated now without hedging. Determinism plus a seed is not a diminished authorship. It is a different one, and the difference is the whole discipline. The author of a generative work does not make the artefact. She makes the space, and then she makes the choice of which point in it to show, and both acts are authorship of a harder kind than placing a picture by hand, because the first act commits her to every page she will never see and the second act makes her answer for the one she did. The morphological box was already this, half a century early: a parameter space laid out so its combinations could be counted rather than imagined, an artist declaring that her work was the field and not any single flower in it.

Why a grid, and not some looser thing, some generous canvas that could hold anything. Because only a constrained space can be sampled, and this is the sentence the book was built to earn. A page that could be anything can only be nudged; there is no set to draw from, no legal from illegal, no ground against which a choice could register as a choice. A page that can be one of ten million lawful things can be reached into. Constraint does not subtract from variety. It is the precondition of variety, the frame that turns a smear of possibility into a countable set with a first element and a last (Plate 20). The 1915 rectangle refusing to be a container, the 1958 timetable turning a claim into a method, the 1981 line breaker minimising badness over a whole paragraph instead of grabbing at each line as it came: none of them knew it, but all three were building the fence a sampler needs.

So consider, finally, the physical fact of the thing in your hands, or under your thumb if you are scrolling. This book composed itself out of these rules a moment ago. The pages came due, the beam walked them, the weights scored them, the seed chose. Nothing on this page was placed by a person reaching in at the last instant; it was placed by a person who long

Set in 7 on 8 point on a grid of 6 columns and 9 rows, composed by programme from a space of valid books; this is seed "seed-7". Every rule cites its page in Josef Müller-Brockmann, Grid Systems in Graphic Design (1981). The plates are works of the constructive avant-garde, 1915 to 1930, all public domain, via Wikimedia Commons. Plate 1: Kazimir Malevich. Plate 2: El Lissitzky. Plate 3: Kazimir Malevich. Plate 4: Piet Mondrian. Plate 5: El Lissitzky. Plate 6: Lyubov Popova. Plate 7: Theo van Doesburg. Plate 8: Sophie Taeuber-Arp. Plate 9: Kazimir Malevich. Plate 10: Theo van Doesburg. Plate 11: El Lissitzky. Plate 12: Wassily Kandinsky. Plate 13: Piet Mondrian. Plate 14: Lyubov Popova. Plate 15: Olga Rozanova. Plate 16: Sophie Taeuber-Arp. Plate 17: Theo van Doesburg. Plate 18: El Lissitzky. Plate 19: Sophie Taeuber-Arp. Plate 20: Piet Mondrian. Typeset by GEVIERT, das Geviert, the em quad.