

Signifying Nothing

The Semiotics of Zero

BRIAN ROTMAN

This book portrays the introduction of the mathematical sign zero as a major signifying event, both within the writing of numbers and as an emblem of parallel events in other sign systems.

REVIEWS

"This unusual book is a delightful analysis of the nature of zero as a sign intimately connected to the idea of nothing. Rotman draws interesting parallels using the textual code systems of mathematics, painting, and economic exchange and their respective meta-signs—zero, the vanishing point, imaginary money—which represent the absence of certain signs. Focusing on the Renaissance period, the author argues that the introduction of a meta-sign disrupts a code system and prompts the creating of new sign systems, as represented by the multifarious transitions from Roman to Hindu numerals, from iconic to perspective art, and from gold money to imaginary bank money. Adopting an interdisciplinary approach . . . Rotman builds a viable thesis for the semiotics of zero via a thorough examination of Montaigne's *Essays*, Shakespeare's *King Lear*, the *Kabbalah*, and Vermeer's paintings."

—Choice

"Rotman's book is a tapestry of delicate elaborations on a single beautiful idea, revealing the isomorphisms between the changes which occur in symbol systems. . . . In mathematics a program of 'deconstruction' has definite philosophical appeal. The fascinating richness of this book arises from the way exactly the same semiotic transformations are traced in other symbol systems."

—Radical Philosophy

Stanford University Press

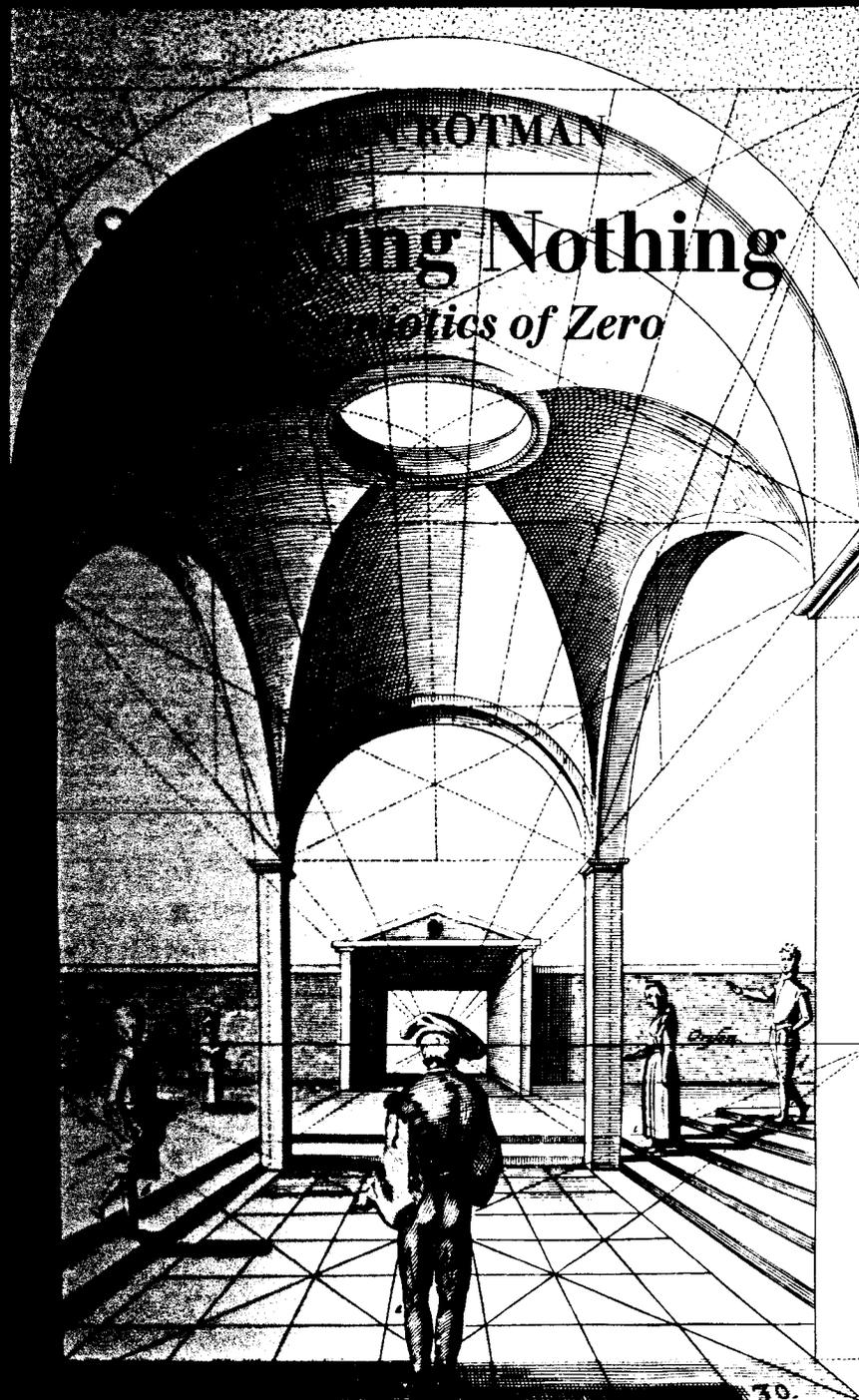
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contemporary economic construction, a current achievement of Western capitalist culture. Now since money is the dominating source of 'value', the image of images, the only absolute given signifying credence in this culture, the question arises whether there ought to be isomorphic patterns, changes parallel to that experienced by money signs, within other contemporary codes. Should one expect to see similar disruptions in the written codes of mathematics, music, visual representation, or the written word? I shall respond only to the last of these questions by giving a brief and oblique description of what, according to the philosopher Jacques Derrida, we must in future mean by 'the text'.

1

Number, Vision, Money

ZERO

It is clear that zero is the true and natural beginning.
(Stevin, 1958, vol. IIB, p. 499)

Zero is not an absence, not nothing, not the sign of a thing, not a simple exclusion. If the natural numbers are signs, it is a signifier. It is not an integer, but a meta-integer, a rule about integers and their relationships.

(Wilden, 1972, p. 188)

Since nothing falls under the concept 'not identical with itself', I define nought as follows: 0 is the number which belongs to the concept 'not identical with itself'.

(Frege, 1974, p. 87)

Zero understood as a number, which assigns to the subsuming concept the lack of an object, is as such a thing - *the first non-real thing in thought*.

Miller, 1977-8, p. 30)

The mathematical sign we know as zero entered European consciousness with difficulty and incomprehension. It appears to have originated some 1300 years ago in central India as the distinguishing element in the now familiar Hindu system of numerals. From there it was actively transmitted and promulgated by Arab merchants; so that by the tenth century it was in widespread use throughout the Arab Mediterranean. Between the tenth and the thirteenth century the sign stayed within the confines of Arab culture, resisted by Christian Europe, and dismissed by those whose function it was to handle numbers as an incomprehensible and unnecessary symbol.

During the fourteenth century, with the emergence of mercantile capitalism in Northern Italy, the handling of numbers passed from church educated clerks immersed in Latin to merchants, artisan-scientists, architects, educated in the vernacular for whom arithmetic was an essential prerequisite for trade and technology; with the result that the texts of those who had long been advocating the introduction of Arab mathematics and in par-

ticular Hindu numerals, such as Fibonacci in his treatise *Liber Abaci* of 1202, became increasingly influential. The central role occupied by double-entry book-keeping (principle of the zero balance) and the calculational demands of capitalism broke down any remaining resistance to the 'infidel symbol' of zero, and ensured that by the early seventeenth century Hindu numerals had completely replaced Roman ones as the dominant mode of recording and manipulating numbers throughout Europe.

Given that the Hindu system offered from the very beginning of the tenth century a clear, efficient, easily learned method for writing numbers and handling calculations (or so it seems now after long familiarity with it), the nature of the resistance the sign 0 encountered for several centuries can be queried. What, from a semiotic point of view, might have been so difficult and alien about the number zero? One answer would be that zero, being somehow about 'nothing', became therefore the object of a hostility to 'nothing' already entrenched within Christian orthodoxy. I shall return to this answer and the nature of this hostility later. For the present I want to focus on the question in terms of the purely formal properties of zero as a signifying item within the decimal notation for numbers.

Though there are many different ways of talking about the mathematical concept of number, there is in all discussions a *sine qua non*: the activity of counting. It seems to be impossible to imagine any picture, characterisation, elaboration, or description of numbers that does not rely on a prior conceptual familiarity (whether this be explicitly formulated or assumed as background knowledge) with the process of counting. And since counting requires the repetition of an identical act, it is impossible to imagine the creation of numbers – as a mathematical activity of writing signs – without invoking characteristic patterns of concatenated marks such as:

1, 11, 111, 1111, 11111, 111111, 1111111, etc.

formed by iterating the operation of making some, indeed any, particular mark.

These patterns acquire significance as the elements of an ordered sequence of mathematical signs, as soon as the 'etc.' symbol is interpreted as a mathematical imperative, a command addressed to a subject, instructing him to enact the recursive rule: copy previous inscription then add another mark; the rule, that is, which means continue counting.

Seen in this way, numbers become *potentia*, theoretical possibilities of sign production, the imaginable signifying acts of a subject-who-counts. In a strict sense, therefore, they are not to be identified with the signs 1, 11, 111, etc. Rather, these signs are records left by the one-who-counts, particular representations of numbers recorded in a written medium.

However, the historical precedence of signs such as these – in the form of notches, scratches, and tally-marks – over all known systems of numerical

notation allows us to consider them as a kind of proto-number; thus simplifying the discussion of numerals, since any system of names for numbers, such as the Roman or the Hindu system, can be taken as a systematic rewriting of the signs 1, 11, 111, etc. As such, each system of numerals arises as a different solution, with its own desiderata and semiotic priorities, to the same fundamental problem: how to re-convey, through a system of signs which preserves the different numerical identities of the individual proto-numbers, the activity of the counting subject.

The principal semiotic feature of the proto-numbers is the iconic manner in which they function: each constituent sign, each '1' in the typical proto-number 111...1, has for its signified a 'unit' which records a single act within the process of counting, with a plurality of such acts being recorded by a *corresponding* plurality of signs. Moreover, because they are identical and interchangeable, the constituent signs combine commutatively. The order in which they are written is immaterial. Any system of numerals will, therefore, introduce abbreviations, conventions of syntax and grammar, designed to de-iconise the proto-numbers. With this in mind let us compare Roman and Hindu numerals.

In its earliest form the Roman system of numerals was based on the signs I, V, X, L, (, I), (I) for one, five, ten, fifty, one hundred, five hundred, one thousand respectively. The introduction of printing in the fifteenth century brought modifications: the sign '(' became C, the sign '1)' became D, and (I) became M, thus masking the recursive, exponential facility the system possesses whereby ((I)) was ten thousand, (((I))) was a hundred thousand, and so on. By writing these original signs alongside each other, with the convention that concatenation was to be interpreted as addition, so that for example MMMMDCCCLXXXVI represented 4 thousands plus 7 hundreds plus 8 tens plus 6 units, the Roman system was capable of producing a numeral for any number that its users could conceive.

Despite its abbreviations, the Roman way of notating numbers, like those languages that express the plural by repeating the singular, did not detach itself from the iconic mode, as is witnessed in the writing of MMMMMMMMMM for 9 thousand and so on. (Subsequent modifications introduced an order into the syntax through the subtractive principle whereby IX represented 9 and so on, leaving iconicity to remain in II for 2, III for 3, IIII for 4, MMMM for 4 thousand, and so on.) Independently of these features the system's use of the operator (-) was confined to powers of ten – ((I)) was permitted but ((II)) was not – so that while one million was written as (((I))), it would have been necessary (had Roman arithmeticians ever considered the number) to resort to iconic duplication and write (((I)))(((I))) for two million, and so on. The result of this curtailment in the use of the operator (-) was that the syntactic structure of Roman numerals assumed an arbitrary, heterogenous, and locally complex character.

One consequence of this *ad hoc* syntax was an overcomplicated grammar:

performing all but the most elementary *calculations* with Roman numerals assumes a laborious, byzantine, impractical character. Ordinary multiplications, for example, require such intricate sign manipulations as to render the Roman system virtually unworkable as a computational medium. And indeed, throughout its history there is no evidence that the system of Roman numerals was used or ever intended to be used for calculation. Instead, calculations were carried out, not as manipulations of written numerals, but as operations on the beads of a counting-board or *abacus*.

An abacus, as a machine which keeps track of the process of counting, consists of an array of grooves or wires determining an ascending series of rows on which counters or tokens are positioned. Tokens on the bottom row represent units, the next row tens, the next hundreds, and so on. Additionally, intermediate rows are possible with a token representing a 5, or a 50, or a 500, and so on. The state of the abacus – the configuration of positions occupied by its tokens – can express and be determined by a unique numeral. Thus, the numeral MMMMDCCLXXXVI would correspond to the state:

| | | | | | | | | | |
|---|--|---|--|---|--|---|--|---|--|
| M | | o | | o | | o | | o | |
| D | | o | | | | | | | |
| C | | o | | o | | | | | |
| L | | o | | | | | | | |
| X | | o | | o | | o | | | |
| V | | o | | | | | | | |
| I | | o | | | | | | | |

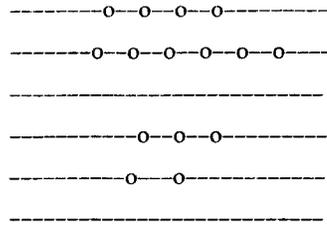
In a calculation, the tokens would be manipulated according to the rule that two tokens on an intermediate row or five on any other row would be replaced by a token on the next row up; the result of the calculation being the final state of the abacus. (see Illustration 1).

In the period between the tenth and thirteenth centuries the *abacists*, who wrote Roman numerals but calculated with the abacus, were in conflict with the *algorists*, who both recorded and calculated with Hindu numerals. For the abacists what was objectionable about the algorists' procedure was not any rejection of the notational principles associated with the abacus, since if intermediate rows are ignored, Hindu numerals correspond just as naturally to the state of the abacus as Roman ones; indeed, the very form of the correspondence, whereby the state



REISCH'S MARGARITA PHILOSOPHICA: 1503

Illustration 1 Gregor Reisch: *Margarita Philosophica*. The two forms of calculation contrasted, with Boethius representing the use of Hindu numerals and Pythagoras that of the abacus.



is written as 460320, seems so natural as to make it plausible that the origin of Hindu numerals was in the writing down of abacus states. (A suggestion made indirectly by Needham (1959, p. 11) where he remarks that zero's etymological connection to 'emptiness' might be related to the empty spaces that occur in the abacus.) Indeed, the difficulty for the abacists lay in the algorists' treatment of empty rows, and the effect this had on calculations. For the abacist, the occurrence of a row with no tokens on it, far from presenting any special problem, made it easier to write down the state of the abacus, since to do so fewer signs were required. Unlike the case with Hindu numerals, no Roman numeral ever had to register the *absence* of some particular power of ten.

The fundamental obstacle for the abacists was, of course, the peculiar use of the zero sign by the algorists; a sign which affected values of numerals wherever it occurred but had no value itself, and which appeared as a number in calculations though it answered to no positive or real quantity.

The etymology of zero, via 'cypher' from the Hindu *sunya* (= void), clearly recalls its intimate and long-standing connection both to the idea of an empty meaningless character and to the notion of 'nothing' or no thing. In any event, there is no doubt that, as a numeral, the mathematical sign zero points to the absence of certain other mathematical signs, and not to the non-presence of any real 'things' that are supposedly independent of or prior to signs which represent them. At any place within a Hindu numeral the presence of zero declares a specific absence: namely, the absence of the signs 1, 2, . . . , 9 at that place. Zero is thus a sign about signs, a meta-sign, whose meaning as a name lies in the way it indicates the absence of the names 1, 2, . . . , 9.

If zero is a name it is also none the less a *number*. Here, too, its meaning is to indicate the absence of mathematical signs; specifically, the absence of the proto-numbers 1, 11, 111, 1111, etc. Such an absence – in effect the potential, yet to be realised, presence of any positive integer – can be construed in two different ways depending on whether the numbers produced by

counting are seen as cardinals or ordinals. If we interpret counting cardinally, then the proto-numbers appear as signs that iconically mark out fixed pluralities via a tallying procedure which assigns the typical proto-number $11 \dots 1$ to a *corresponding* plurality of counted objects; a process that makes zero the cardinal number – nought – of the empty plurality. In other words, zero marks the theoretical limit of this sort of one to one correspondence; the point at which a counting subject, instead of tallying idealised marks to objects, must signal the complete absence of any such corresponding mark. If counting is interpreted ordinally, the proto-numbers 1, 11, 111, etc. appear as records which mark out by iconic repetition the sequence of stages occupied by a counting subject. Zero then represents the starting point of the process; indicating the virtual presence of the *counting subject* at the place where that subject begins the whole activity of traversing what will become a sequence of counted positions. It is presumably this trace of subjectivity, pointed to but absent, that Hermann Weyl (1949, p. 75) was referring to when, in his constructivist account of the mathematical subject, he characterised the origin of coordinates, represented by 0 on the line and by (0,0) in the plane and so on, as the 'necessary residue of ego extinction'.

Thus, zero points to the absence of certain signs either by connoting the origin of quantity, the empty plurality, or by connoting the origin of ordering, the position which excludes the possibility of predecessors. These connotations constitute zero's role as a meta-sign formulated in terms of, but separate from and exterior to, the proto-numbers. But zero also occurs within the domain of 'number' in direct arithmetical contact with ordinary numbers. In such equations as $0 = 0$, $1 - 1 = 0$, $3 + 0 = 4 - 1$, $3(2 - 2) = 0$, and so on, zero appears explicitly as a number among numbers, having the same status as, operating on the same plane as, and interchangeable with, the other numbers.

It is this double aspect of zero, as a sign inside the number system and as a meta-sign, a sign-about-signs outside it, that has allowed zero to serve as the site of an ambiguity between an empty character (whose covert mysterious quality survives in the connection between 'cyphers' and secret codes), and a character for emptiness, a symbol that signifies nothing.

Finally, one can see that zero, by signifying the absence of signs, facilitates the lifting of calculations from the abacus onto paper; the shifting, that is, from 'counter-casting' with physical number tokens, to 'pen-reckoning' with the written Hindu numerals themselves. To move from abacus to paper is to shift from a *gestural* medium (in which physical movements are given ostensively and transiently in relation to an external apparatus) to a *graphic* medium (in which permanent signs, having their origin in these movements, are subject to a syntax given independently of any physical interpretation). Thus, the absence of tokens on an abacus row will be *used*. It will have meaning in use: material, gestural, computational, significance within the

course of an abacus calculation, but it will not figure as a sign in any Roman numeral description of the abacus. It will never be *mentioned*, as it must be if it is to become an explicit object of graphic manipulation.

In short: as a numeral within the Hindu system, indicating the absence of any of the numerals 1,2,3,4,5,6,7,8,9, zero is a sign about names, a meta-numeral; and as a number declaring itself to be the origin of counting, the trace of the one-who-counts and produces the number sequence, zero is a meta-number, a sign indicating the whole potentially infinite progression of integers.

THE VANISHING POINT

The vanishing point is the anchor of a system which *incarnates* the viewer, renders him tangible and corporeal, a measurable, and above all a visible object in a world of absolute visibility.

(Bryson, 1983, p. 106)

This singular moment [Brunelleschi's demonstration] marks the realization of one of the most profound ideas in all of world history: the perceptual 'truth' of linear perspective.

(Edgerton, 1976, p. 125)

In 1425, a century or so before Galileo is said to have demonstrated linear acceleration by dropping his celebrated cannonball from the tower in Pisa, the architect Brunelleschi held up a mirror in an equally momentous and dramatic experiment in front of the Baptistery in Florence to demonstrate the illusionistic power of linear perspective.

With the Baptistery directly in front of him, what did Brunelleschi do? Imagine a square canvas with a painting on it depicting the scene in front of you. At a certain point in the canvas a pinhole is made. Would it be possible, by looking through the pinhole from *behind* the canvas at a square mirror placed to block the scene, to see, reflected in the mirror, a perfect copy of the scene (see Illustration 2)?

Because mirrors reverse left and right, such an effect, for it to work at all, requires the scene being viewed to be symmetrical about a vertical axis; a condition satisfied by the view of the Baptistery Brunelleschi chose to confront. It also requires that the set-up be exactly right: that distances between canvas, mirror, and scene be in the correct geometric proportion. More particularly, the demonstration rests in a critical way on the precise nature of the visual coding used to represent the scene on the canvas. What Brunelleschi's experiment showed was that if the depiction was carried out according to a certain systematic procedure, subsequently codified as the rules of artificial or linear perspective, then indeed there *was* a position on

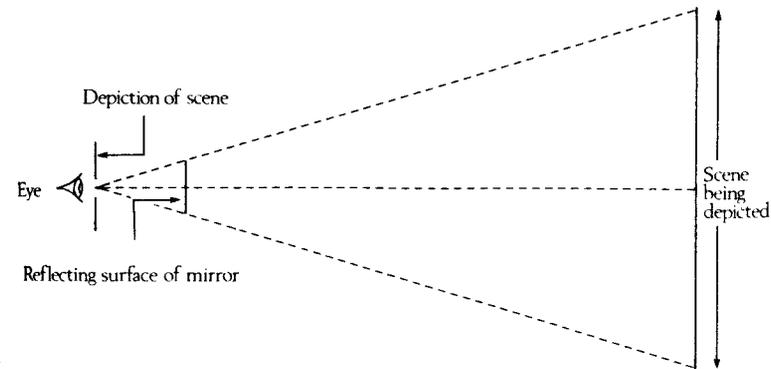


Illustration 2 Diagram of Brunelleschi's experiment. Cross-section of optic cone whose vertex is situated at pinhole through which mirror is monocularly seen.

the canvas for a pinhole through which the required illusory mirror image could be seen (see Illustration 3).

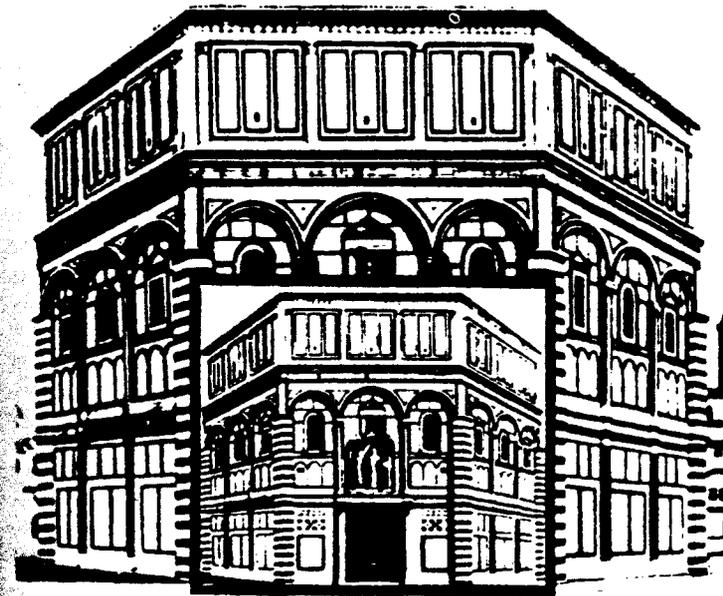


Illustration 3 Simulation of Brunelleschi's experiment. Simulated mirror view through pinhole of depicted image of Baptistery set against Baptistery itself.

Within a short time the effect so palpably demonstrated by Brunelleschi was theorised into a system by Alberti, and then clarified, developed, extended, and modified by (among others) Piero della Francesca, Uccello, Leonardo in Italy, and by van Eyck, Viator (with qualification), Dürer and de Vries further afield. The result was the emergence of a code of visual depiction that has dominated all subsequent Western attempts to represent the look of solid, occupiable space by means of a two-dimensional image.

The technical background to the emergence of Brunelleschi's demonstration, considered as a two-dimensional illusory presentation of space, contained several strands. In terms of physical artefacts these were: the growing introduction of flat (as opposed to convex) mirrors and the optical theories they gave rise to; the rediscovery of Ptolemaic map-making with its central idea of the projection of territory onto a flat surface; the long-known but new found attraction of the *camera obscura* with its ability to transfer illusory, life like portrayals of visual reality onto any surface. The relative importance of these artefacts, either as models or as indirect causative influences on the emergence of perspectival seeing, is a subject for historical dispute and does not, in any case, concern us. This is because we are interested in the code of perspectival art purely abstractly, as a formal method, a semiotic system of rules for generating an infinity of picture signs: each of which offers an illusionistic representation, artificially organised around a single point, of some real or imagined visual scene.

This being so, there is, however, one historical aspect of the system that does require elaboration, if only because it is a constituent of the system itself: the centrality and practical importance of *proportion*, the growing pre-occupation with arithmetical ratios, among the merchants, architects, artisan scientists, and painters who formed the audience for Brunelleschi's demonstration.

Baxandall (1972) describes how problems relating to proportion dominated the educational curriculum, aesthetic framework, and cognitive style of the period in which Brunelleschi and Alberti formulated their ideas. The importance of such problems, if not their origin, stemmed from the exigency of mercantile capitalism: the pressing need to conduct transactions between countries and city states each possessing different systems of weights, volumes, measurement, and currency. This required a simple, instantly applicable way of handling such exchanges within an arithmetical formalism; a formalism which at its simplest level – where it was called 'the rule of three' – answers the question: if the proportion of A to B is the same as that of C to D, and if A, B, C are given, then what is D? The 'rule of three' – essentially no more than equality between arithmetic ratios – was, as Baxandall well illustrates, elevated into a central, universally taught, cognitive principle that imposed itself on trade, architectural design, and painting.

Clearly, the rule of three' is an important facilitating tool for a system of

painting basing itself on proportional enlargements and foreshortenings of the visible world. But proportion and the ability to instantly calculate it do not by themselves add up to a system of linear perspective: one also needs a point of projection from which all ratios are determined. In fact, in the absence of any such external originating point, proportional ratios occur spatially in the form of similar triangles within Euclidean geometry. And Euclidean space – in which there are no signs for isolated points other than those that are either posited outright or exist through the intersection of figures – is radically different from a projected, coordinated space; a space in which every position is signifiable in relation to the horizon and centric ray as axes and the vanishing point as origin of coordinates. (Indeed, the mathematical space appropriate to perspectival images is that of projective geometry which, in order to study the effect upon plane figures of changing the position of the point of projection, postulates a point at infinity as its origin.)

The procedure for making a perspective painting is simple enough: the scene, a fragment of the visible world, is to be viewed framed as if through a fixed rectangular window. To depict the scene the painter has to create a screen which, if placed filling the window, would at least in principle fool the eye into the belief that it was witnessing the original scene. In order to make the appropriate counterfeit image the painter imagines lines in space connecting objects to his eye; where these lines intersect the screen he makes his marks (see Illustration 4). If he keeps his viewing eye always in the same spot, then these marks will be signs which represent, continuously point for point, the surfaces of things within the visible world.

Among these signs there is one, situated on the horizon, with a uniquely privileged status: the method of perspective demands that while lines parallel to the screen are represented by parallel lines (transversals) which recede to the horizon line, those witnessed as perpendicular to the screen are represented by a cone of lines convergent to a single point. The sign occupying this point – the point where Brunelleschi must have made his pinhole – is known as the *vanishing point* or 'point of flight'. And it is this sign which organises the perspectival image for the spectator.

The transversals, by receding away from the spectator, mark out the depth of the pictorial space. Extended in the opposite direction out of the frame of the picture towards the viewer, they allow the ground on which the depicted figures and buildings stand to merge with that of the spectator. The spectator has the illusion of being drawn frontally into the picture towards the vanishing point (see Illustration 5).

Many early Renaissance painters, as if to emphasise the essential otherness and exteriority of this location, placed the vanishing point inside a hole: a framed opening, such as a door, a window, a mirror, or even another painting, within the visual scene. This had the effect of doubling the pull



Illustration 4 Albrecht Dürer: the designer of the sitting man.

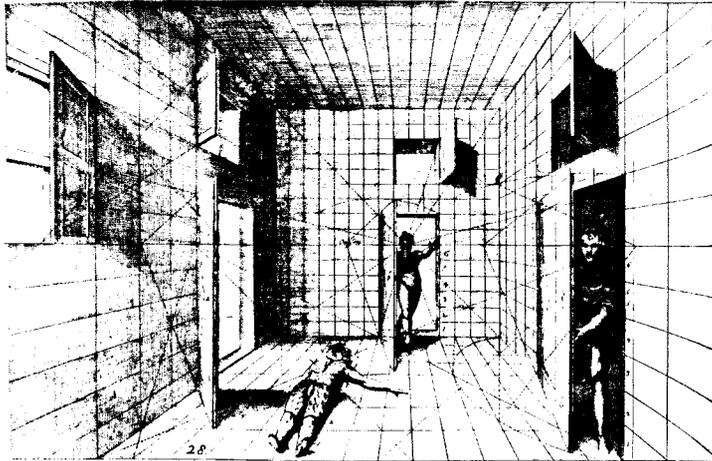


Illustration 5 Jan V. de Vries: *Perspective*, plate 28.

exerted by the vanishing point on the spectator, and at the same time, by invoking the potentially unlimited iteration of a frame within a frame, of pushing the vanishing point out to an infinite, unreal, numinous distance.

What is exceptional about the vanishing point in relation to other locations within the picture is its dual semiotic character. Like zero it plays a very specific double role. Internally, as a sign among signs, it acts as a depictive sign on the same plane as other such signs. Accordingly, like them it represents a definite location within the real physical scene witnessed through the window frame; a location that by being infinitely far in the distance, however, is unoccupiable by a person or indeed any physical object. Externally, the vanishing point is in a meta-linguistic relation to these signs, since its function is to organise them into a coherent unified image. Its meaning, in other words, can only be retrieved from the process of depiction itself, from the way the original subjective act of witnessing is represented via the rules of perspective as an image addressed to a spectator.

One can observe how the vanishing point functions as a visual zero facilitating the generation of an infinity of perspective images as zero generates an infinity of Hindu numerals. And just as zero mediates between two different subjectivities – facilitating the transition from the gestural to the graphic subject – so the vanishing point, ambiguous between its lingual meaning as an internal sign, and its external, meta-lingual sense, offers the spectator the possibility of momentarily becoming, via a thought experiment, the artist. By looking through one eye, from a certain point on the centric ray (the line through the vanishing point perpendicular to the plane of the painting), the spectator can mirror the artist's monocular witnessing and painting from what he imagines to be the corresponding point within the depicted scene. Thus, the vanishing point, by marking the artist's horizon point, that is the spot he faces on the horizon of the scene he depicts, becomes the mark of the spectator's horizon point. The spectator sees from the artist's 'point of view'.

We can see from this, as Brunelleschi so spectacularly dramatised, that the vanishing point acts as a mirror, reflecting back to the spectator an imagined version of himself, a fictive visual self in the guise of the artist (see Illustration 6).

Each image within the code of perspectival art thus offers the spectator the possibility of objectifying himself, the means of perceiving himself, from the outside, as a unitary seeing subject, since each image makes a deictic declaration: this is how I see (or would see) some real or imagined scene from this particular spot at this particular instant in time. Being able to signify such a particularised individuality equips the perspective code with the visual equivalent of a demonstrative pronoun, allowing the code to deal in messages whose interpretation requires the active presence of a physically located, corporeal individual who has a 'point of view'. Presumably, the very idea of a subject having a point of view, within a discourse

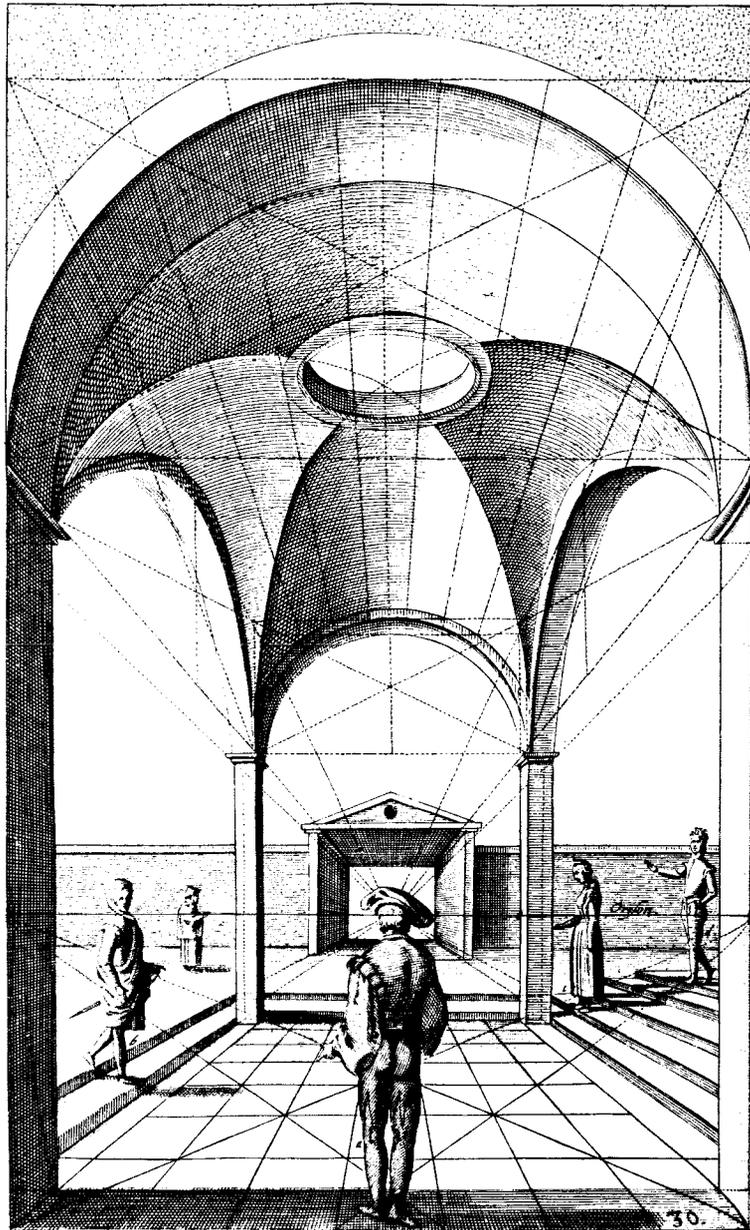


Illustration 6 Jan V. de Vries: *Perspective*, plate 30.

in the figurative sense, has its origin in the system of mirror depiction introduced by Brunelleschi.

In any event, just as the fundamentally iconic basis of Roman numerals is foreign to zero's meta-linguistic capacity to connote the trace of the one-who-counts, so the iconic images of Gothic art are silent about the nature of visual authorship and exclude the possibility of signifying demonstratively. What gives a Gothic panel its unity, its visuo-conceptual coherence, allowing different places to coexist and different historical realities to impinge on each other, is not some visual mode particularised in an individual artist/spectator, but the all-seeing timeless, spaceless eye of God.

In the fifteenth century this divine eye was vividly concretised by N. de Cusa (1928) in *The Vision of God or the Icon*; a book that de Cusa, a cardinal of the church, sent to accompany the gift of a devotional artefact, a painted portrait, which offered the brethren of a monastic order an 'easy path unto mystical theology' (p. 1):

If I strive in human fashion to transport you to things divine, I must needs use a comparison of some kind. Now among men's works I have found no image better suited to our purpose than that of an image which is omnivoyant – its face, by the painter's cunning art, being made to appear as though looking on all around it. There are many excellent examples of such faces . . . Yet, lest ye should fail in the exercise, which requireth a figure of this description to be looked upon, I send for your indulgence such a picture as I have been able to procure, setting forth the figure of an omnivoyant, and this I call the icon of God.

(de Cusa, 1928, p. 3)

For de Cusa the, to us, banal phenomenon of depicted eyes that appear to be looking at whoever is looking at them was an iconic device for arriving at an understanding of God's vision. As God is omnivoyant, seeing all instantaneously, his *viso* – glance, gaze, regard – viewing the past, future, present, the near, the distant, as one, in the same timeless moment, so the portrait's depicted eyes 'see' in a way that transcends human vision. De Cusa instructs the monks to hang the painting on a north wall and perceive its wonders, first of static omnivoyance – any looker, wherever he is, feels himself to be the object of its gaze – and then dynamically:

If now, while fixing his eye on the icon, he walk from west to east, in like manner it will not leave him. Then will he marvel how, being motionless, it moveth, nor will his imagination be able to conceive that it should also move in like manner with one going in a contrary direction to himself.

(de Cusa, 1928, pp. 4-5)

And so on, until the monks, by repeated contemplation of His icon, come to know the mystery of God's omnivoyance and 'the gaze that never quitteth' (p. 5).

The iconic mode of signifying whereby like is signified by like, where the material of an iconic sign, its signifier, is supposed to image or resemble what it signifies, dominates the code of pre-perspectival visual images: just as its arithmetical version – the repetition of signifiers to signify repetition as in two lots of X being XX, three lots of X being XXX and so on – dominates the pre-Hindu Roman code of numerals. It relies upon a 'natural' order of similitude, a world of intrinsic likenesses that exist before signs. Thus, in categorising his gift as an icon, de Cusa appeals to this world of pre-existing 'natural' sight in which it makes sense for the omnivoyance of the depicted eyes to mimic the gaze of God. And thus, too, the use of gold in medieval paintings to signify the presence of God: gold as intrinsically beautiful, changeless, precious, immutable serves as the perfect icon of a God who is beautiful, changeless and so on.

In short, where medieval painted images make God's invisible prior world manifest through 'natural' icons, Renaissance images represent an anterior visual world through a convention of signs, artificially produced by a humanly imposed system of perspective. Interestingly, as the art historian Gombrich (1963, p. 17) points out, Alberti, in his treatise on painting, urged the rejection of gold in favour of white as the appropriate sign for holiness. White, by being at the same time a possible colour on a par with any other colour and a meta-colour, a sign indicating the absence of colour, reflects the systematic ambiguity of the vanishing point. Thus what Alberti wanted white to perform for God's presence in the domain of colour, the vanishing point had already accomplished for the presence of the artist in space.

This rejection of gold – concrete, iconically precious, 'natural', intrinsically valuable – in favour of abstract, semiotically neutral white finds a reflection, as we shall now see, in the signs of money, where the possession of palpable gold is displaced by the intangible assurance on a promissory note.

IMAGINARY MONEY

If most contemporaries found money a 'difficult cabbala to understand', this type of money [assignable bills of exchange], money that was not money at all, and this interplay of money and mere writing to a point where the two became confused, seemed not only complicated but diabolical.

(Braudel, 1974, p. 358)

'Zero stroke' or 'cipher stroke' is the name created by German physicians for a prevalent nervous malady brought about by the present fantastic currency figures. Scores of cases of the 'stroke' are reported among men and women of all classes, who have been prostrated by their efforts to figure in thousands of millions. Many of these persons apparently are normal, except for a desire to write endless rows of ciphers.

(Quoted by Galbraith, 1975, p. 157)

The transition from Roman Hindu numerals based on zero, and from the code of iconic art to perspectival art based on the vanishing point, is reflected in the field of economic activity by a fundamental shift in the structure of money signs that occurred in the passage from feudalism to mercantile capitalism.

In the classical Marxian formulation economic modes of society differ in the manner in which they extract and dispose of the time spent by men in labour surplus to that necessary to reproduce themselves as economic beings in society: in feudalism such surplus value in the form of products became part of the visible wealth of the Feudal lord. The use-value that arose from labour was materialised in products which were concrete and meaningful to the producer, satisfied human needs in a local sense, and were inextricable from the social context of their making. In capitalism, what arose from labour was exchange-value materialised in commodities; these were abstract, lacking in social history, and meaningful only to the extent that they were bought and sold within transactions. For the capitalist, surplus value was turned into invisible capital, and had 'all the charms' as Marx, interested in just such a facility, put it 'of a creation out of nothing'.

To isolate a purely semiotic dimension of the transformation from feudal use-values to capitalist exchange-values, and identify the meta-sign through which the shift from a product to a commodity takes place, we must focus on the underlying system of signs which facilitated these changes – that of money.

The reintroduction of gold money into Europe in the late middle ages superimposed on the prevailing barter economy a universal pricing system. Gold became both the standard against which the value of goods could be measured and the substitute in the mechanism of exchange replacing the exchange of goods by the transfer of currency. There is, however, nothing intrinsically capitalist in the sort of metallic economy brought about by gold; the transactions it made possible were essentially transposed acts of barter. The money which facilitated them lay outside these transactions: money could not be bought and sold – a crucial distinction. (True, there existed money changers who might at first glance be considered to have performed such a function; but though they dealt in currencies, they did so only to the extent

of exchanging them one for another, bartering them in a manner identical to the bartering of goods for which the currencies themselves had been introduced as substitutes.) The advent of gold money, then, allowed the barter system to replicate itself at another, money based, level. It did not in itself produce any rupture within the medieval barter economy: only when this money could be bought and sold – when money entered into a relation with itself and became a commodity – did the feudal code constructed on the notion of a product become disrupted and replaced by the code of commodities engendered by mercantile capitalism.

But in order to buy and sell money, rather than merely trade one currency against another, a new type of money is needed to provide the medium of exchange and institute the code in which such transactions of currency are to take place. This new money, which will not itself be a currency in the old sense, will introduce itself as a new type of sign; a sign external to and in principle unrepresentable within the sign practices governing the use of gold money. How did such money signs originate?

As a sign, gold money's principal characteristic and mode of operation is iconic, in the sense that the manner in which it signifies derives not from any arbitrary conventional pairing of sign vehicle and signified value, but from gold's physical nature as precious metal, possessing worth and being valuable, prior to any act of signification. As Foucault (1973) puts it:

The value of [gold] money must be determined by the quantity of metal it contains; that is, it returns to what it was before, when princes had not yet stamped their effigy or seal upon pieces of metal . . . arbitrary signs were not accorded the value of real marks; money was a fair measure because it signified nothing more than its power to standardize wealth on the basis of its own material reality as wealth.

(Foucault, 1973, p. 169)

This reliance on its own materiality, whereby gold money operates through signifiers whose weight is supposed to guarantee the sign values in question, contains an inherent instability. As a circulating sign, gold money runs up against the problem faced in principle by any iconic sign, that of physical debasement. A gap arises between 'good' money (the pure unsullied issue of the state) and 'bad' money (the worn and fraudulently diminished coins in circulation). This gap in signified value between the ideal, nominal signifier corresponding to the face value and the materially debased signifier which reduces the sign to a function of its actual, that is contingent, weight became known as the *agio*. As a kind of average debasement the *agio* was, according to Adam Smith:

The supposed difference between the good standard money of the state, and the clipt, worn, and diminished currency poured into the country from all the neighbouring states.

(Smith, 1976, pp. 474–80)

It was on the basis of this difference between good and bad money that a new type of monetary transaction and a new form of money emerged in those mercantile states, such as Venice and Amsterdam, whose international trade was especially vulnerable to the instabilities caused by debasement. The solution adopted (the same in each state) was for a bank of the state to create a new 'imaginary' coin, such as *Marc Banco*, *Florin de Banque* and so on, whose value was specified externally, in a global sense, as a fixed weight of gold or silver and internally, in a local sense (via the *agio*) as a determinate but variable amount of gold money exchangeable for it. These imaginary coins were a form of credit issued by the bank. And naturally enough:

This credit was called *bank-money*, which, as it represented money exactly according to the standard of the mint, was always the same real value, and intrinsically worth more than current money.

(Smith, 1976, p. 480)

Such imaginary money was not embodied: it had no physical currency; it did not materially circulate as gold or silver coin; it could not, therefore, be debased. It functioned as a money sign, not through any iconic replication of value in its own vehicle, but by convention, through a mutual understanding between a bank and an individual. In effect, it was a promise to pay, given by the bank to a particular merchant in exchange for gold money.

The individualising of money signs in this way, whereby imaginary money is deictically rooted in the signature of a particular named payee, creates what is essentially a monetary pronoun completely parallel to the visual pronoun generated by the vanishing point. Clearly, this deixis (which, as we shall see later, is the site of the next change in money signs) represents a complete break from the unrooted, freely circulating anonymity of gold coins.

Indeed, in relation to the signs of gold money, imaginary money is, like zero and the vanishing point, a certain sort of meta-sign which both participates in and initiates a new sign practice: bank money, by systematically attaching a sign to current money different from its manifest value, converts gold money into a commodity. It thus has a dual relation to the system of monetary exchange, being both internal to the system as money able to buy goods and be exchanged for appropriate amounts of currency, and external to it – originating the very medium of exchange which allows money to become a commodity.

This dualism between sign and meta-sign is the semiotic reading of the opposition between what was felt to be real and what was imaginary about money signs. The Mark Banco or Florin de Banque appear as 'real' money, that is actual elements within the total system of money signs, freely exchangeable, substitutable, and on a par with the other signs there. They also appear as 'imaginary' money, that is a meta-sign whose meaning arises outside these signs in a relation of origination to them: since it is only through bank money that gold money moves from a sign iconically determining value for feudal products to a sign among signs in the code of commodities created by mercantile capitalism.

2

Emergence of a Meta-Subject

ANTERIORITY OF THINGS TO SIGNS

Each of the transformations described so far, in arithmetical signs, picture signs, and money signs can be thought of as a different model of the following abstract scheme:

There is a *system* (Hindu decimal place notation, principles of linear perspective, mechanism of capitalist exchange) which provides a means of producing infinitely many *signs* (numerals, pictures, transactions). These signs *re-present* (name, depict, price) items in what is taken to be a *prior reality* (numbers, visual scenes, goods) for an active human *subject* (one-who-counts, one-who-sees, one-who-buys-and-sells). The system allows the subject to enact a *thought-experiment* (calculating, viewing, dealing) about this reality through the agency of a *meta-sign* (zero, vanishing point, imaginary money) which initiates the system and affects a *change of codes* (gestural/graphic, iconic/perspectival, product/commodity).

I want now to deconstruct this scheme. What lies at its centre, explicit in the talk of 'prior' reality, is some supposed movement into signification, some shift from object to sign, from presentation to representation, from a primary given existence to a secondary manufactured description. In each of the cases of number, vision, and money a field of entities is assumed to exist anterior to the process of assignation performed by the system. What are taken to be pre-existing numbers are given names, scenes from some supposedly pre-existing visible world are depicted, goods conceived as existing independently of, and prior to, the agency of money are assigned a price. In each case this process of assignation hinges on the meta-sign which both initiates the signifying system and participates within it as a constituent sign. And it is this double ambiguous role played by zero, by the vanishing point, by imaginary money, which ultimately destabilises the scheme presented here and deconstructs the anteriority to signs this reality is supposed to enjoy.

In other words, the simple picture of an independent reality of objects providing a pre-existing field of referents for signs conceived after them, in a naming, pointing, ostending, or referring relation to them, cannot be sustained. What gives this picture credence is a certain highly convincing illusion. Once the system is accepted, on the basis of a perfectly plausible original fiction, as a mechanism for representing some actuality, it will