Sybille Krämer

Reflections on 'operative iconicity' and 'artificial flatness'

Introduction: beyond the dichotomy of word and image

A new awareness has emerged for the role that images play in our knowledge practices. What is often diagnosed by the fine arts as a 'withdrawal from the picture' is shown by the sciences to be a remarkable entry of the picture into a field in which images – if considered at all – were mostly perceived as mere illustrations. In the course of digitalized research methods, which are entirely dependent on the visualization of their results, the pictorial as an intellectual device is gaining a new scientific dissemination and dignity. The image and with it the questions of conditions, scope and limits of scientific visualization have become core epistemic questions. However, a closer look at the history of scientific practices shows that they have never been able to do without the visualization capabilities of images, schemata, graphs and diagrams.[1]

In the wake of the historical and epistemological revaluation of the image, a phenomenon appears that will concern us in the following chapter. It is about an operative form of iconicity that belongs to the field of 'useful images'[2] or 'utility images'[3]: to this class of graphically oriented iconicity we count – in an undoubtedly simplifying triad – writings, diagrams or graphs as well as maps.[4]

Intuitively, it is clear that these visual phenomena cannot easily be assigned to the form of the pictorial that is embodied in a painting or a photograph. The reason is, that the language-like character of media like graphs, diagrams and maps is obvious; this character however, reveals itself – strictly speaking – as a 'language of space'.

1 Galison 1997; Heßler 2006; Latour 1990; Maasen et al. 2006.
2 Original: „nützliche Bilder", Boehm 2001.
3 Original: „Gebrauchsbilder", Majetschak 2005.
4 Krämer 2009.

Published in: David Wengrow (Ed.), *Image, Thought, and the Making of Social Worlds*, Freiburger Studien zur Archäologie & Visuellen Kultur 3. Heidelberg: Propylaeum 2022, 251–272, DOI: 10.11588/propylaeum.842.c10813

While speech is usually a process of fleeting acoustics and proceeds in temporal succession, these languages of space are rooted precisely in the representational potential of visible, conservable and 'frozen' relations, the arrangement of which feeds on the two-dimensionality of the surface as well as on the simultaneity of what is presented over the surface. But we are familiar with such attributes like two-dimensionality and simultaneity in the realm of 'ordinary' pictures. Such an interweaving of the linguistic and the pictorial makes one attentive; for we are accustomed to differentiating our symbolic capacities in almost classical-canonical typologization into the discursive and the iconic, into linguistic representation and pictorial presentation. The fact that word and image form two semiotic modalities that are clearly distinguishable and not traceable to one another is confirmed by the assumption of a 'pictorial turn',[5] inasmuch as it already establishes an opposing relationship to the 'linguistic turn' through its name and wants to take up its heritage.

In the face of this dichotomous opposition of language and image, we want to suggest that the discursive and the iconic, the saying and the showing are only the two conceptually stylized poles of a scale on which all concrete, i.e. spatio-temporally situated phenomena appear in differently proportioned mixing ratios in between word and picture.

Does the 'exit' of the image from the domain of the fine arts and its 'entry' into the domain of the arts of knowledge and their history also mean becoming aware of precisely those 'images beyond the pictures' that are also 'a language beyond the linguistic'? And which thereby hold a potential for representation for which there is no analogy in either the oral languages or in ordinary images?

A first indication of the transgression of this opposition between word and image is given by the phenomenon of writing. In the horizon of an alphabet-oriented concept of writing, scripts were regarded as a secondary system of symbols referring to language as their primary system: writing is written down oral language, is spatially fixed speech.[6] This 'phonographic dogma' categorizes writing as a form of language – and not as an image. Imported with this speech-centered concept of writing was the assumption of the constitutive linearity of writing: the temporal sequence of oral sounds is spatialized in the linear sequence of letters. But this phonetically reduced concept of writing falls short.

On the one hand, writing can refer to all sorts of things, even the Greek alphabet notated not only language but music and numbers.[7] On the other hand, musical scores, crossword puzzles, chemical formulae, written arithmetic, but also tables of contents, footnotes, indices in texts show how far the use of writing breaks with the

5 Mitchell 1992.
6 Günther – Ludwig 1994, VIII.
7 Kittler 2003.

principle of linearity.[8] All kinds of written text work within the two dimensions of the surface insofar as they do not only run in lines to the right or left, but can also be read from top to bottom, often in column form. Scripts thus form an interface between the discursive and the iconic. Graphical attributes such as underlining and italicising, upper and lower case, punctuation or the distinction between continuous text and footnotes document that the linguistic arbitrary principle is also suspended, according to which a word has no similarity with the thing it designates. In many respects, the typeface of the written text already shows what is important in its interpretation; semantics contour the notational iconicity of written or printed texts.

The concept of 'notational iconicity' developed in recent years[9] aims to overcome the phonocentric concept of writing and to design a theory of writing that synthesizes the discursive and the iconic dimension. This synthesis unfolds an exploratory potential of writing that finds no analogy either on the side of 'pure' pictures or 'pure' oral languages.[10]

We have already mentioned that the intertwining of the pictorial and the linguistic is relevant for many cognitive and scientific processes. Here I offer some reflections, in order to draw attention to a medial attribute of our use of writing, graphs, diagrams and maps, which mostly remain a blind spot, and is scarcely reflected upon. These mostly concern the phenomenon of 'artificial flatness' used as a cultural technique; it can explain, why 'operative iconicity' is creative and productive in the realm of intellectual work.

We will first introduce and explain the cultural historical use of 'flattening out' with some examples. The examples are intended to convey very different ways of using inscribed and illustrated surfaces, distinguished in terms of cognition and also their underlying epistemic values. They will help to give an *intuitive* insight into what the phenomenon of artificial flatness used as an operative device is all about.

Flattening the sky: constellations as sky diagrams

The sky is populated with constellations making up a surface from the universe's depths. A hardly fathomable sea of stars is endowed with order, by being shaped into manageable groups. The transformation of points of light into elements of a figure takes place by means of connective lines, invented by humans. Physically, the stars brought together in constellations have nothing to do with each other. What

8 Harris 2000.

9 Krämer et al. 2012.

10 Cf. Severi, this volume.

is moved into neighborly proximity and transformed into the elements of a unified figure is in reality separated by light years.[11] It is the line that levels differences; it renders what is disparate and distant into elements of the same form.

Each constellation that culture has marked as significant is transmitted and canonized through a range of variable sketches, diagrammatic and mimetic drawings, and mythological-literary descriptions. Only those who have already gained knowledge from looking at these texts and images, will be able to identify stable structures within the countless flood of stars.

Let us look at three different representations of 'Orion' (**Fig. 1–3**):

Fig. 1: Orion photography (http://www2.vobs.at/hs-goetzis/tech/sterne/orion.2.jpg)

11 In Orion, the star Betelgeuse is 642 light years away from us, Bellatrix "only" 243 light years.

Fig. 2: Orion schema (http://1.bp.blogspot.com/-HT8gypOaLKg/T8VLBJzyZrI/AAAAAAAABY/52iru6DYo_E/s1600/Orion_Grafik.JPG)

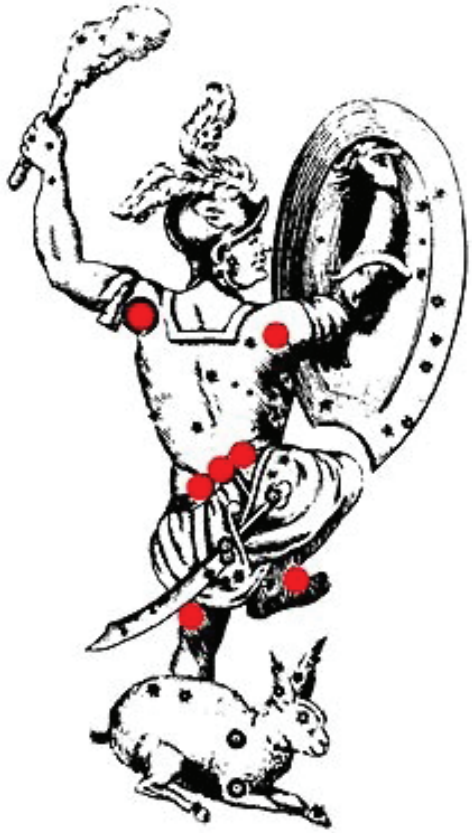

Fig. 3: Mythological/mimetic representation (Archive Krämer)

We see the schema of the constellation Orion *within* the different concrete images. A certain abstract order and proportionality is preserved from image to image. What is projected onto the heaven is a schema, a structure originally born within diagrammatic and pictorial practices.

Constellations are not an end in themselves. Historically they serve as an orientation and self-indexicalisation. Such a localisation by constellations can only be realized through a connection of spatial and temporal dimensions: a constellation can only be used to identify a terrestrial locus if the temporal movement of the celestial image is also calculated. As a means of orientation, constellations are useful, even if the popular astronomical knowledge sedimentised within them is hardly productive for scientific astronomical visualization.

That we can master and instill order in the chaotic manifoldness of the celestial stars through the practice and rediscovery of diagrammatic mapping – and virtually all cultures have a place for constellations – is a gesture of sovereignty. What is inaccessible becomes an accessible and useful instrument of orientation, what is unfathomable is given comprehensible order, the infinite is transformed into incisive form. Constellations present this metamorphosis in a paradigmatic way. And in 'flattening the sky', the practice of diagrammatic inscription plays a decisive role.

Platonic diagrammatical procedures[12]

Plato's Menon dialogue is designed to show that knowledge is not transferable from one person to another through language and telling, yet knowledge has to be produced by the knowing subjects.[13] This is demonstrated using the situation of a mathematically uneducated slave boy. Socrates draws a two-foot square in the sand and tells the youth to double the area.

The boy first doubles the length of the sides of the square, but he recognizes that this fourfold increase is too much. He then increases the length of the sides to three feet, but – as he can see – this also produces a square that is more than twice as large. The boy is puzzled and admits that he is irritated: "I don't know," he confesses to Socrates. With the aid of further questions, in which Socrates does *not* communicate the technique of doubling a square, and further geometrical drawings, the boy finally recognizes that it is possible to double the area by constructing another square from the diagonal (**Fig. 4**).

12 Krämer 2016a.

13 Platon, *Menon* 82b–85c.

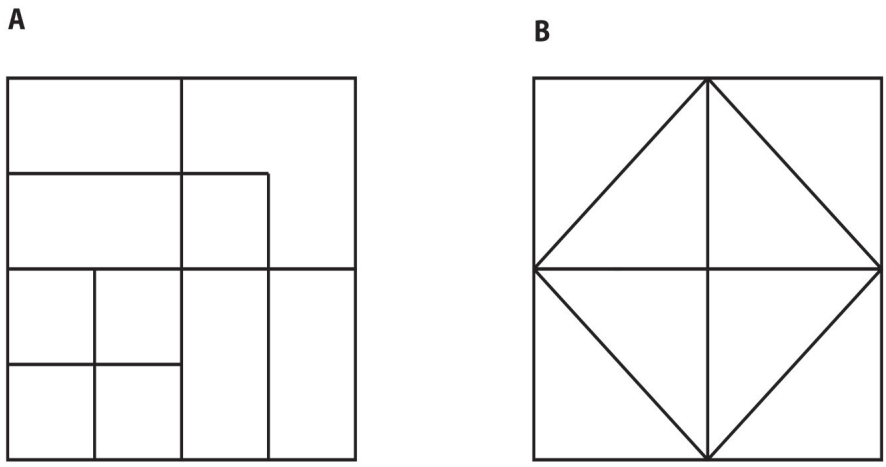

Fig. 4: Fig. A contains the squares drawn by mistake (Politeia, 82b–84c); Fig. B contains the squares leading to the solution (84d–85b) (Krämer 2016, 162).

What does this 'diagrammatic primal scene' reveal? The first steps of the engagement with the drawing involve the realization not of knowledge but rather of a *lack of knowledge*. An intellectual mistake literally becomes *visible*, and the perceptibility of this *false* assumption paves the way for the next steps of producing the positive mathematical knowledge. It is a surface which becomes the experimental field of insight, insofar as the drawing is always also revisable: everything that is visualized by drawing can be drawn differently.

Let me only mention here, that similar scenes of diagrammatical reasoning can be found in a lot of other Platonic texts. For example, the technique of *dihairesis*, which is a method for defining concepts: a concept is visually broken down in dichotomously structured binary components. It is meanwhile historically proved, that this kind of defining by drawing was practiced at the Platonic Academy (**Fig. 5**).[14]

What is an angler?[15]. Beginning with the initial division of an uppermost conceptual distinction between skilled and unskilled activities, the answer diagrammatically leads to a term that is no longer divisible, namely the 'angler', which is dichotomously distinguished from the 'harpoon fisher'. *Dihairesis* is a technique that 'spatialises' these intelligible objects by situating them in quasi-visualisable planar arrangements of words. Conceptual relationships are rendered visible as lexical arrangements. An almost architectural design is created in which

14 Philip 1966, 335.
15 Platon, *Sophistes* 218e–221b

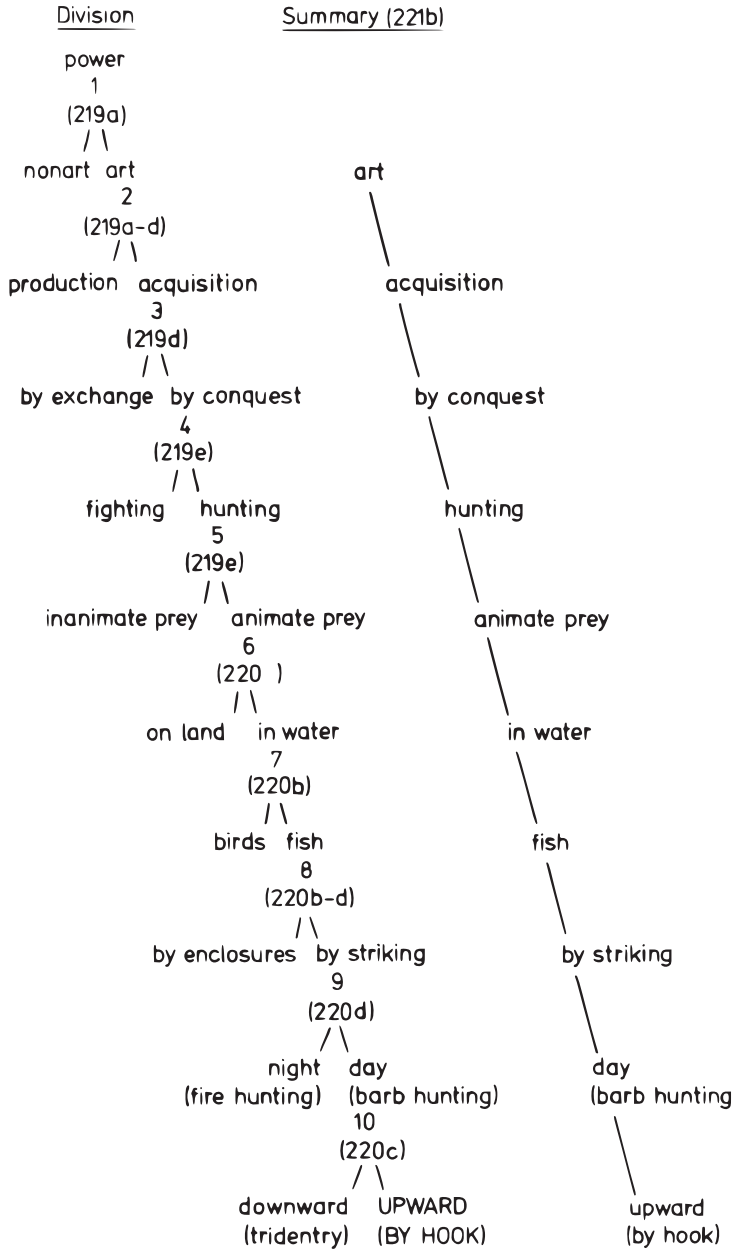

Fig. 5: *Dihairesis* of the 'angler' (Archive Krämer)

concepts are constructed from components, and conceptual fields are structured according to the correlation between part and whole, upper and lower. Partition and linkage: These are the basic operations opened up by *dihairesis*' strategy of spatialisation. Planar spatiality as a medium for the act of thinking could hardly be articulated more clearly.

How the mathematician Gauß baffled his teacher

According to an anecdote[16] about the mathematician Carl Friedrich Gauß (1777–1855) as a nine-year old boy, his teacher once wanted to occupy his class for a long time, so he gave them the task of determining the sum of the first one hundred numbers. The pupils made tedious calculations, which mostly resulted in the wrong answer, but Gauß produced the correct answer within minutes: 5050.

How did he do it? Although his calculations involved not drawing lines but rather only inscribing and revising sequences of symbols, what matters here is that Gauß' answer was based on using the *spatial* properties of inscriptions, such as positioning, grouping, and regrouping.

The addition of the first 100 numbers can be written as a sequence of numbers in their chronological order:

1+2+3+4+....97+98+99+100

This chronological order (1) can be altered through transposition, grouping, and the insertion of brackets, which allows the first and the last numbers to be brought together, the second and the second-last numbers, and so forth, as the *commutative law* of addition allows the arbitrary ordering of numbers to be added and the *associative law* states that the summands can be arbitrarily grouped using brackets.

(1+100) + (2+99) + (3+98) +.....(49+52) + (50+51)

An *optical* situation arises from this revision, as it becomes apparent that the sum of the numbers in each set of brackets is the same – namely, 101.

(101) + (101) +....(101) + (101)

16 Hayes 2006.

In so far as there are 50 such sets of brackets, it is only necessary to calculate 101 multiplied by 50 yields 5050. 5050 is the solution.

You have never seen a number: numbers do not have any inherent position in space and time, but they *acquire* a visible sensibility and manipulable position on a plane through their representation as numerical sign configurations. The operations of shifting and regrouping create a visual configuration that enables the 'aha experience' or 'sudden insight' that each of these newly formed groups has the same value – namely, 101. It is sufficient to observe only the first and last sets of bracketed pairs in order to solve the problem.

The discovery of an effective and elegant solution to the problem is thus made possible by operating with a *written* arrangement spatially.

Artistic and scientific use of shadows

The next two examples refer to the origins of Art and Science[17] by using shadows as a flattening technique. First to the artistic use of shadows (**Fig. 6**).

The shadow is the forerunner of projecting three dimensional bodies as two dimensional pictures. In the legend of the daughter of the potter Butades in Pliny's Naturalis Historia[18] the silhouette of a distant lover engraved on a wall becomes the origin of pictorial art within Western tradition. Pliny's legend shows how the irrevocable passage of time is potentially averted through spatialization. It is the graphical line, which has the power of transfiguration: it converts time into space – and vice versa.

The epistemic function of shadows can be seen in the widespread ancient use of sun dials, which enable the measurement of time (**Fig. 7**). The hours of the day are readable through the length of the shadows cast by illuminated things. The Roman architect Vitruvius describes the working of an ancient sundial in his Ten Books on Architecture.[19] A pointer – the gnomon – is placed in a whole within a network of lines, constructed as a diagram based on astronomical observations and mathematical calulations. The shadow of the gnomon allows the hour of the day and the month of the year to be observed. Here it is not the fixed yet the *mobile* shadow which matters. It makes time observable as spatial, visual movement on the diagram of a surface.

17 Bogen 2005.
18 Plinius, *Naturalis historia* 35, 15.
19 Vitruvius, *De architectura* 9, 1, 1ff.

Fig. 6: Joachim von Sandrarts „Teutsche Academie", 1675. Butades' Daughter (http://www.mpg.de/1382475/zoom.jpg)

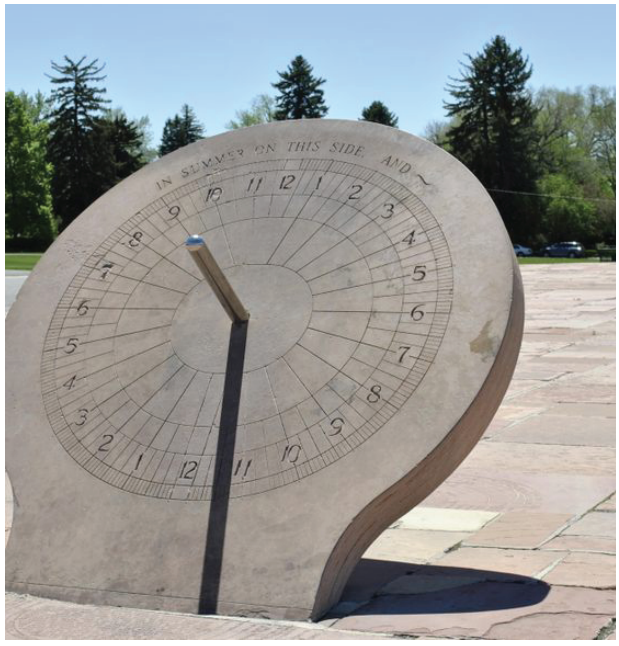

Fig. 7: Sundial (https://www.atlasobscura.com/places/cranmer-park-sundial)

Artificial flatness[20]

We live in a three-dimensional world, but we are surrounded by surfaces that are covered with images and writing. From cave paintings to skin tattoos to graffiti, from painted pictures to written notations, from diagrams, technical drawings, and maps to film, television, computer screens, tablets, and smart phones, our everyday practices are permeated with surfaces that represent something. Compositional work is hardly possible without musical notation, just as spoken theater is attached to scripts and dance performances often depend on choreography. Scientific work is inconceivable without formulas, texts, tables, and graphs. Illustrated and inscribed surfaces are so ubiquitous and commonplace that we no longer notice the special form of *spatiality* that they incorporate.

A surface is the outer skin of a voluminous body; it always corresponds to an underlying deep structure. A plane, on the other hand, is spatially extended but without depth. We treat the surfaces of fairly flat yet still three-dimensional objects *as if* they have no depth. The virtual metamorphosis that transforms three-dimensionality into two-dimensionality is first triggered by the act of drawing and writing. But please note: planes do not empirically exist. Surfaces *are* not planes; rather, they *are treated* as planes.

Our body institutes a basic system of spatial orientation through its three perpendicular axes. Everything that surrounds us is divided into right or left, over or under, before or behind. Artificial flatness abolishes the dimension of depth so that only two registers of spatial order are projected onto the surface: right/left and over/under. What is erased is the dimension of the behind, which in our three-dimensional environment marks the region of the hidden and uncontrollable. Flatness thus negates the unobservable and uncontrollable 'behind' and 'below'. An illustrated or inscribed surface embodies a completely overlookable and controllable space – at least so it seems – whose handy format often makes it easy to transport and circulate.

The fullness of the real world as well as the phantasms of fictional worlds thus obtain an observable and manageable form; things that are not or that can never be (such as images of logically impossible objects) are made perceptual too.

An illustrated or inscribed surface can even become a laboratory of cognition as well as a workshop for aesthetic experimentation and a tool of technical instruction (**Fig. 8**). Artificial flatness is a cultural achievement of the first order. Its aesthetic and cognitive ramifications are obvious, yet surprisingly little studied. Just as the invention of the wheel facilitated mobility and creativity in the world of the body, the invention of artificial flatness facilitated mobility and creativity in the world of the

20 Krämer 2016b.

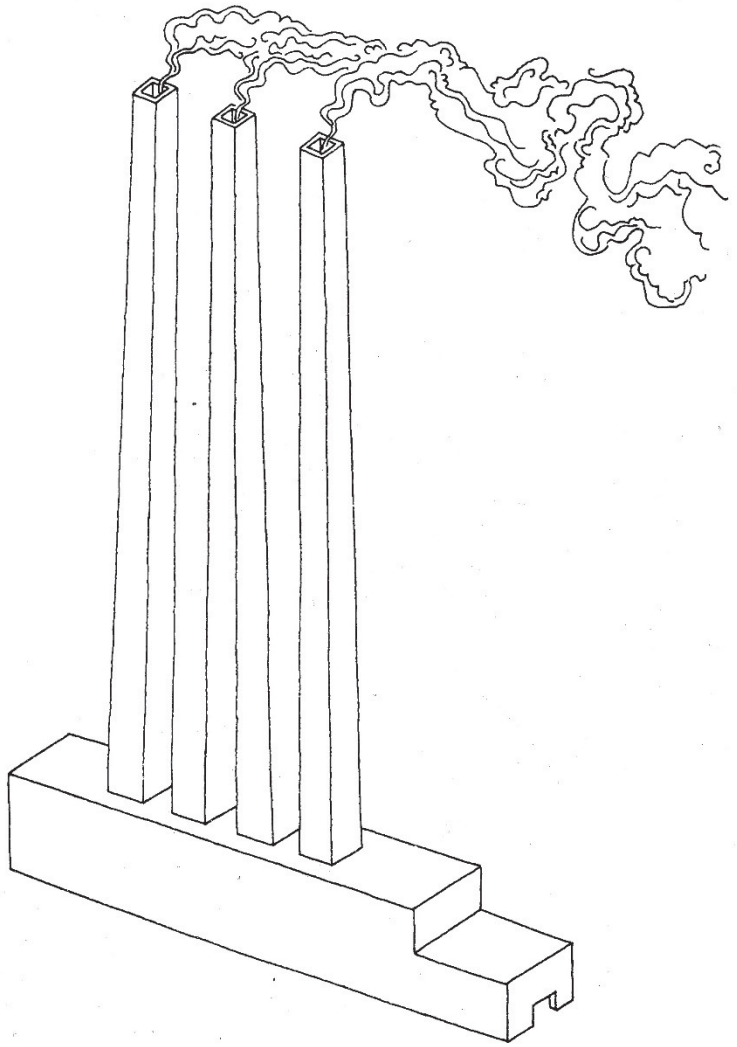

Fig. 8: Oscar Reutervärd: impossible figures (O. Reutersvärd, Unmögliche Figuren. Vom Abenteuer der Perspektiven [Augsburg 1990] 29).

mind. I will refer to the aesthetic and cognitive deployment of artificial flatness as the 'cultural technique of flattening'. Whether empirically scratched or put on: the surface is treated *as if* it is flat. Writing as well as picturing, script and image both depend on flatness as a medium of representation and operativity. No question that there are differences in the degree of flattening. From an aesthetic point of view, the volume of the brush application is aesthetically significant. And also with writings, either

– as in cuneiform writing – the surface is carved or something – as in the ink shaft – is applied to it. But in an epistemic respect based on schematization, writings, diagrams, graphs and maps are two-dimensional inscriptions.

What does it mean for our thought and cognition that nearly everything related to the acquisition, justification, and representation of knowledge is organized in the medium of inscribed surfaces? My guiding idea is to explain this in terms of *a cartographic impulse*. It is well known from everyday life that if we use maps or navigational tools we have to indexicalise ourselves as a point on the map. If that is done, we are able to orient ourselves within an unfamiliar terrain and to target special locations. By analogy we can transfer this 'cartographic impulse' to the cognitive use of artificial flatness as means of intellectual orientation within the 'complex landscapes of knowledge'.

Grammatics of diagrammatics

To understand and describe the use of inscribed surfaces, some fundamental attributes can be proposed:

Directionality

Normally we reconstruct diagrams and graphs in terms of visuality; but rather it is *spatiality* that matters here. Flatness introduces the ordering principle of synopsis, which allows observers and readers to assume a bird's eye perspective with regard to the surface. Based on the use of geographical overview maps we know that the view from above can only facilitate orientation when the map user knows how the topographical arrangement of the map corresponds to actual compass directions: The direction 'north' is conventionally placed at the *top* of the map. Yet the issue of directionality is valid not only for maps but also for texts and images.

It was the philosopher Immanuel Kant who recognized that space is determined not only by extension – as Newton proposed – or by the relation between things – as Leibniz stated – but also by its *directionality*.[21] Like screws and snail shells, illustrated and inscribed surfaces also must have a conventional orientation. Kant himself points to the written page as an example:[22] when it is rotated 180 degrees the internal relation between the symbols does not change, but the text becomes

21 Kant 1768.

22 Kant 1768, 995.

unreadable because it has lost its external relation with respect to the reader: it has lost its familiar conventional alignment. Writing and reading directions paradigmatically document the phenomenon of integrated directionality which holds for any inscribed surface.

Graphism

The interaction of point, line, and plane establishes a kind of activity which is the common root of drawing *and* writing. The paleontologist and anthropologist Leroi-Gourhan[23] points out that our ability to use acoustic language actually has precursors in the signal voices of animals, but there is nothing comparable to the production of graphism and images in the pre-human era. As opposed to the absolutization of the spoken language as an "Ur-humanum", it should be emphasized that people have *two* symbolic registers at their disposal: acoustic *and* visual representational forms. Graphism is a basic human competence. The little-noted phenomenon of doodling[24] – the unintentional drawing of formless shapes that unconsciously change into elementary forms – testifies to this original potential for graphing. Precisely because the pictorial is often identified with the highly stylised forms of art or scientific visualisation, we cannot see the innateness and ubiquity of our everyday capability of graphing. The rehabilitation of this genuinely graphical power of articulation and communication, this 'image-making capacity that is prior to the image' remains a necessary subject of research.

Schematism

Images, diagrams, and writings are things that physically stand before our eyes. They occupy positions in space/time, and are visible, modifiable, and transportable. They are extremely mobile in small formats, and their inscriptions mostly remain stable throughout their circulation. Nevertheless, the materiality that guarantees their sensory presence is fundamentally *replaceable*, it is a kind of schematism.

With the word 'schema' we primarily associate a representation that shows the essential outlines of an object and leaves out 'non-essential' details. 'Schematic' things in this sense are the drawn geometric figure, the organigram, the circuit diagram, and the floor plan. Nevertheless, we have to distinguish between the 'schematic rep-

23 Leroi-Gourhan 1980.
24 Driesen 2016.

resentation' and the 'schema'. Schemata are not simply a special type of reductive representation, but rather instructions that can then be envisaged and realised in different singular images. This schematism separates operative images from the pictorial artwork. Unlike an artwork, which is intimately connected to its material form, the materiality of a diagram or a text is not intrinsic but rather *extrinsic*. Whatever is inscribed on a surface can be reproduced on another surface; a change in material instantiation is possible *without* damaging its content.

Schematism ensures transmissibility: everything represented in point-line constellations can also be transferred or represented in alternative ways.

Relationality

Diagrams do not show objects, but rather relations; diagrams exhibit relations by relations. We see that in star constellations, whose arbitrarily drawn connecting lines place unrelated stars in an 'artificial' relationship. Things and events can be perceived, but not relations between them. Relations are something invisible, but they too acquire a visible and manipulable position on inscribed surfaces. Is the artificial surface the genuine birthplace of the idea of a relation? Martin Heidegger[25] described the concept of a 'relation' as a 'holding-together in keeping-apart': things that are differentiated are related to each other in such a way that their difference is *not* abolished. Diagrams are symbolic instruments which facilitate the comparison of different things without liquidating their difference. If thinking always also means correlating, then it is clear that diagrams understood as graphic apparatuses of correlation, can play a fundamental role in all kinds of thought processes.

Referentiality

Writing refers to something else in order to have an understandable meaning and not to be pure ornamentation. This also applies to diagrams, graphs, and maps, which always refer to something beyond themselves. Yet this 'beyond' should not be misunderstood as a kind of naive reference. For example: Projecting the surface of a sphere onto a flat plane means changing it. Gerhard Mercator's map – as we all know – represents the surface of the earth in a somewhat distorted manner. The 'price' of projection is that a map cannot preserve both the areas and angles of a globe at the same time. Mercator's map was used as an instrument of navigation. To

25 Heidegger 1978, 152.

project territories in their real proportional extent would have made the navigation function impossible.

Topological maps visualize not the world but rather our *knowledge* of the world, configured and formatted for a *particular* purpose. This knowledge normally already exists as mathematical data collections, tables, and written descriptions. The map combines all this knowledge as a cartographic medium. 'Referentiality' should not be understood as an immediate, direct reference to a single object, but to a collective stock of knowledge.

A non-trivial concept of 'transnatural mapping' becomes apparent here. The epistemic value of graphism lies in the formation of *structural similarity or analogy* through graphic schematism, which abolishes *mimetic* similarity. René Descartes's invention of analytic geometry is an example, as it features lines as coordinates with which geometric points can be translated into pairs of numbers. As a result, geometric figures can be represented and processed as arithmetic equations. In this sense, the formula of the circle structurally represents the figure of the circle.

Mediality

Inscribed surfaces are media, and they thus function as places of *transfiguration*: Looking at an empirical stroke with width and length, we see a one-dimensional line; looking at a concrete geometrical drawing, we see an ideal mathematical object; manipulating perceptible signs, we perform mental and cognitive operations. This transfiguration of the visible into something conceptual and therefore invisible allows artificial flatness to be an instrument of thinking. We think not only *on* paper, but also *with* paper. According to my messenger model,[26] a medium is a visible entity that occupies the position of a third in-between two different worlds or systems or parties, and facilitates an exchange between these heterogeneous spheres. Media work especially well when this third is a hybrid that combines the properties of both sides.

Inscribed surfaces realize an *intermediary role*: as two-dimensional forms they stand in-between the one-dimensionality of time and the three-dimensionality of space; as sensory forms that visualize the imperceptible they are situated in-between observation and conception; as technical drawings, assembly instructions, or computer programs they mediate between an abstract plan and its concrete implementation. By virtue of their position as a third, inscribed surfaces function as devices that 'translate' between heterogeneous fields. Media create an interrelationship between

26 Krämer 2015.

things that are different or opposed, such as time and space, observation and conception, visibility and invisibility, program and its execution.

Operativity

We now reach an important point in describing operative iconicity: diagrams and writing are *dynamic devices*. Like a geographical map, which enables personal movement in unfamiliar terrain, diagrams and texts facilitate intellectual actions in complex areas of knowledge. The surface transforms into a space for exercising memory, for problem-solving and cognition, for artistic, scientific, and technical designs. Operative iconicity not only represent situations and relations, but also *intervene* in them.

This kind of representation often enables the creation of what it represents. Does an argument exist, before we create written logic, able to configure sentences in a discrete, quasi architectonic order? Does language, understood as a *verbal* communication system, separated from gesture, mimic, prosody and deixis really exist, before the Greek alphabet intended to represent speech in difference to other dimensions of communication? Does a point exist in the sense of a non-extended mathematical entity before it obtains a diagrammatic-operative basis as the center of a circle or a point of intersection between lines? Does zero exist as a number before it is calculated in writing with the numeral 'O' or becomes the center of a coordinate axis? Visualization, operationalization, and generation are intertwined, and between the poles of embodiment and disembodiment they acquire the status of abstract objects of knowledge and invisible theoretical entities, which are established as epistemologically perceptible and tangible objects.

Sociality (and digitality): a conclusion

My last point is the intersubjectivity, the sociality of diagrams. Diagrams introduce intuition in the intersubjective 'mode of the We'. They organize supra-individual and epistemically *shareable* experiences. Diagrams can be passed not only from hand to hand but also from 'eye to eye' and thus from 'mind to mind' precisely because they are 'objects of intuition' and 'instruments of thought' situated in space-time. The often-mentioned term 'eye of the mind' is not an internal, mental eye; rather, it is objectively based on the intersubjective clarity of script and diagrams. To understand the epistemic functioning of diagrammatical and notational iconicity is part of a *social epistemology*.

This is underscored by their normativity. These norms are not necessarily explicit, as there are often implicit conventions that regulate the use of inscribed surfaces. The fact that the values on a number line increase from left to right or that east is right on a map is normal yet arbitrary, as it could also be otherwise. Inscribed surfaces would not be accessible without an awareness of these implicit social rules and conventions. Diagrams, graphs or maps do *not* interpret themselves.

We might conclude: the artificial two-dimensional space has a productive cognitive power: whenever we do not know something, the graphic projection of complex content onto a surface makes the invisible visible, as relations and connections become viewable and complexity becomes manageable. A synoptic overview is furnished, which allows operations to be performed with diagrams and inscriptions. Every symbolic structure can be restructured, and every configuration can be reconfigured. An examination of the function of inscribed surfaces thus reveals that they are used not only as instruments for *visualizing* information but also as tools for *gaining*, *operating* and *exploring* information. The invention of artificial two-dimensionality created a space of overview, control, and manipulability, as the graphic interaction of point, line, and plane enabled the visualization and observation of invisible, theoretical concepts. The cultural technique of flattening and its cartographic impulse are achievements without which the artistic, scientific and technical developments of the modern age are unthinkable.

However, a final and important question then arises regarding the productive and creative role of artificial flatness. What happens under the condition of *digitality*, when the inscribed surfaces evolve into electronically networked interfaces and when graphic user-interfaces begin to control our interactions not only with computers but with the world and even our 'self'? Under the conditions of the electronic interface the cultural technique of flattening assumes a radical new signature. Interfaces have a double face: In many respects the graphic *user interface* directed towards the user is rooted in the traditional writing and reading practices associated with scripts, pictures, diagrams, maps etc. However, the *rear side* directed towards the apparatuses and data networks restores *depth dimensions* which 'originally' the flat inscription practices associated with writing and visualization had annulled. Behind the interface there is a graduated network of nodes and links composed of numerous layers which, instead of connecting man and machine, now just connect computer to computer and data streams.

In contrast to the *operative iconicity* of inscribed surfaces, the protocol-controlled levels behind the user interface, its 'subfaces', are characterized by an *apparent non-iconicity*. The user interface becomes the outer skin of a black box consisting of interactional computers, data bases, and algorithms which are guided and controlled by technical protocols. Analogous to a rhizome, proliferating beneath the

surface of user-friendliness is a region of reinvigorated 'secrecy', of expropriation, of constitutive nescience. Each piece of software creates a 'virtual machine', which remains concealed to those operating the software. The competence derived inductively by computers from vast data sets through self- or deep-learning AI programs, remains impenetrable in 'how' these acquired rules and routines interact – even to the developers. And the manifold data traces left by users on the Internet and on social media, which are analyzed by algorithms to profile people and to predict their future behavior, usually stay hidden from the consciousness of their originator.
To reflect on all this will be another story.

References

Boehm 2001
G. Boehm, Zwischen Auge und Hand. Bilder als Instrumente der Erkenntnis, in: B. Heintz – J. Huber (eds.), Mit dem Auge denken. Strategien der Sichtbarmachung in wissenschaftlichen und virtuellen Welten (Zürich / New York 2001) 43–54

Bogen 2005
S. Bogen, Schattenriss und Sonnenuhr. Überlegungen zu einer kunsthistorischen Diagrammatik, Zeitschrift für Kunstgeschichte, 68 (2), 2005, 153–176

Driesen 2016
Ch. Driesen, Theorie der Kritzelei (Wien / Berlin 2016)

Galison 1997
P. Galison, Image and Logic. A Material Culture of Microphysics (Chicago 1997)

Harris 2000
R. Harris, Rethinking Writing (London 2000)

Günther – Ludwig 1994
H. Günther – O. Ludwig (eds.), Schrift und Schriftlichkeit. Writing and its Use. Ein interdisziplinäres Handbuch internationaler Forschung. An Interdisciplinary Handbook of International Research (Berlin / New York 1994)

Hayes 2006
B. Hayes, Gauss's Day of Reckoning, American Scientist 94, 2006, 200–205

Heidegger 1978
M. Heidegger, Der Satz vom Grund (Pfullingen 1978)

Heßler 2006
M. Heßler (ed.), Konstruierte Sichtbarkeiten. Wissenschafts- und Technikbilder seit der Frühen Neuzeit (München 2006)

Kant 1768
I. Kant, Von dem ersten Grunde des Unterschiedes der Gegenden im Raume, in: I. Kant, Vorkritische Schriften bis 1768 2, ed. by W. Weischedel (Frankfurt a. M. 1996) 991–1000 (Akademie-Ausgabe: AA 2, 375–383)
Kittler 2003
F. Kittler, Zahl und Ziffer, in: S. Krämer – H. Bredekamp (eds.), Bild, Schrift, Zahl (München 2003) 193–204
Krämer 2009
S. Krämer, Operative Bildlichkeit. Von der 'Grammatologie' zu einer 'Diagrammatologie'? Reflexionen über 'erkennendes Sehen', in: M. Hessler – D. Mersch (eds.), Logik des Bildlichen. Zur Kritik der ikonischen Vernunft (Bielefeld 2009) 94–123
Krämer 2015
S. Krämer, Media, Messenger, Transmission. An Approach to Media Philosophy (Amsterdam 2015)
Krämer 2016a
S. Krämer, Is there a Diagrammatic Impulse with Plato? 'Quasi-Diagrammatic-scenes' in Plato's Philosophy, in: S. Krämer – Ch. Ljungberg (eds.), Thinking with Diagrams (Boston / Berlin 2016) 161–178
Krämer 2016b
S. Krämer, Figuration, Anschauung, Erkenntnis. Grundlinien einer Diagrammatologie (Berlin 2016)
Krämer et al. 2012
S. Krämer – E. Cancik-Kirschbaum – R. Totzke (eds.), Schriftbildlichkeit. Wahrnehmbarkeit, Materialität und Operativität von Notationen (Berlin 2012)
Latour 1990
B. Latour, Drawing Things Together, in: M. Lynch – St. Woolgar (eds.), Representation in Scientific Practice (Cambridge, Mass. / London 1990)
Leroi-Gourhan 1980
A. Leroi-Gourhan, Hand und Wort. Die Evolution von Technik, Sprache und Kunst (Frankfurt a. M. 1980)
Maasen et al. 2006
S. Maasen – T. Mayerhauser – C. Renggli (eds.), Bilder als Diskurse, Bilddiskurse (Weilerswist 2006)
Majetschak 2005
S. Majetschak, Sichtvermerke. Über den Unterschied zwischen Kunst- und Gebrauchsbildern, in: S. Majetschak (ed.), Bild-Zeichen. Perspektiven einer Wissenschaft vom Bild (München 2005) 97–121

Mitchell 1992
W. J. Thomas Mitchell, The Pictorial Turn, Art Forum, March 1992, 89–95
Philip 1966
J. A. Philip, Platonic Diairesis, Transactions and Proceedings of the American Philological Association, 97, 1966, 335–358
Platon, Menon
Platon, Werke in 8 Bänden, ed. by G. Eigler (Darmstadt 1990), vol. 2. Menon 505–600, 82b–85c
Platon, Sophistes
Platon, Werke in 8 Bänden, ed. by G. Eigler (Darmstadt 1990), vol. 6. 220–401, 218e–221b
Plinius, Naturalis historia
Gaius Plinius Secundus, Naturkunde / Historia Naturalis in 37 Bd., Book 35: Farben, Malerei, Plastik, ed. and transl. by R. König (Düsseldorf / Zürich 1997)
Vitruvius, De architectura
Vitruvius, De architectura libri decem = Zehn Bücher über die Architektur, transl. and ed. by C. Fensterbusch (Darmstadt 1964)