PICTORIAL STATISTICS FOLLOWING THE VIENNA METHOD[1]

OTTO NEURATH

Science tells us about stars, stones, plants, and animals, and likewise about people and their life together. Science supports its laws and observations based on *experience*.

In its most modern incarnation, science is especially interested in preserving facts *visually*. Astronomical facts are being photographed directly, while the trajectories of stars, specters, and crystalline structures are captured by photography in an indirect way. Photography shows us the behavior of ants and children, and even with audio recordings we are being acquainted through visualization. Where static photography is not sufficient, cinema jumps into the fray. A fleeting comparison between older and more recent research will teach us about this expansion of the *visual protocol*, with recording machines taking the place of manual entries.

However, it is not only protocols that are using visual devices; the *representation of results* also increasingly uses them.

Pedagogy seeks to invigorate the students' activity not least by subjecting simple observations or scientific results to analysis, which in some cases may also include the combination of new forms.

Especially since Comenius's *Orbis Pictus* the problem of how to

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spread enlightenment with the help of methods of visualization has been treated again and again.

The *drawing* and the *image* are being joined by the *model*. We won't be able to show successfully how gradually a system emerges from the depiction of individual things and assorted oddities until we have further developed our means of visual representation. From enabling images to become mobile—already early on, using all kinds of primitive shutter mechanisms—it is only a small step to show models in motion.

In the simplest of cases, images or models reflect facts that can at any rate be grasped easily. Beyond that, images and models may represent, either at a smaller scale or based on a selection, *systems of facts or masses of things that the eye is not capable of perceiving all at once*. Among these we count all spatial representations of the orbits of planets—often using special designs dating from the Renaissance—in order to show eclipses of the sun and the moon, the rise of the seasons, etc. Among these we count all kinds of plans and maps, especially the planiglobes and planispheres that take the place of unwieldy globes.

In this way flat or corporeal images early on became dominant in the fields of astronomy, geography, mineralogy, botany, and zoology. Physics and chemistry are following suit. The 19th-century *technology fairs* and the *museums of technology* that developed out of them have provided an impressive education of the masses. The *hygiene fairs* and *hygiene museums* followed suit.

Where the technology museums had focused on the *machine* as man's tool that was treated as the achievement of inventors—the ancient heroes of the modern age—, the hygiene museums devoted themselves to the *human body*, its composition and functions, the development of diseases and their elimination. In the process both types of museum also touched on the *social effects* of technology and hygiene and they took note of the *social conditions* under which technical and hygienic innovations emerge; however, only a small part of the optical devices served these goals.

THE VISUAL MAPPING OF SOCIAL CONDITIONS

The visual representation of social conditions is a problem that cannot be tackled casually; it demands carefully elaborated methods, since here we are not dealing with a simple, more or less schematic depiction but with a visual representation of large quantities of things and the relations between them.

In literature we occasionally find—more frequently in recent decades—efforts to represent *statistical facts* using images. The most widespread method is to show a greater quantity of people or things by means of a larger image of a person or a thing.

This rough method does not permit any serious visual comparison, especially since the figure whose height has been doubled will, adjusted to regular proportions, have to represent an expanse of more than double the size and an even larger volume. The ensuing visual insecurity is not apt to leave a good memory of the proportional relationship in question.

On military maps the *tactical units* (companies, squadrons, batteries) were entered by means of *conventional signs* based on their numbers. Over two pages, the *ordre de bataille* of two fighting armies would show the quantified equipment of both military corps with their individual divisions in a systematic order of signs. However, this method was almost never applied when social facts were to be depicted.

More precise scientific and popularizing representations would use a confusing array of methods for visualization: squares, circles, rectangles, and curves were often shown randomly throughout the same book, even on the same page. In another chapter [. . .] I have demonstrated that these methods are not pedagogically equivalent, even where they deliver the same mathematical results. The fact that one square has twice the surface area of another square can only be calculated mathematically; it cannot be *seen* with one's eye. What can be done handily, however, is to quantitatively compare two aligned rectangles with *one* other rectangle that is isolated from the others. In this way the entirety of the graphic means of representation can be analyzed pedagogically.

All these graphic visualizations suffer from the fact that it remains unclear what the representation refers to. A green column can refer to births as well as automobiles. *Speaking signs* are therefore an important requirement for such representations: *A larger quantity of things is to be represented by a larger quantity of speaking signs.*

On this basis the Museum of Society and Economy in Vienna began, in 1924, to work systematically on the creation of an international pedagogical method for the representation of social facts.

The task consisted in making *important quantitative relationships of social life easy to grasp* and to *remember.* Most people, including those who might respond well to quantitative relationships, are intimated by

numbers, regardless of whether they appear in astronomic, physical, or sociological representations. Curves and surface areas also intimidate many, and not without reason. Most people's memory is not capable of handling this kind of thing.

Some people may just about retain certain statistical details they stumbled upon by chance, but they lack the possibility of comparing such numbers to others, to integrate them within a larger edifice. Most people first have to be sensitized to appreciate *social proportions*, especially for *dimensions on the scale of humanity*.

Only on such a basis can social and economic observations be successfully constructed. Without a statistical basis familiar to us, anything else we learn becomes either an entity without contours or a teeming mess from which particularities stand out for entirely coincidental reasons.

An example. Whether we are talking about export opportunities for European and American markets or about war and revolution, it is essential to know how approximately the quantity "yellow people" relates to the quantity "white people." Experience shows that individuals with an academic degree, not counting the specialists, will be inclined to think that there are about four times as many "yellows" as "whites." People with less education will settle for only three times or twice as many. Those, however, who for example at the Museum of Society and Economy in Vienna [. . .] have engrossed themselves in the panel devoted to "The World's Ethnic Groups" are unlikely to forget that there are roughly as many "yellows" as "whites." How to explain such grave errors, especially among the reading intelligentsia? Today's publications are full of imprecise emotional expressions. We hear about China's "incredible density" and are even inclined to apply this to the entire national territory including its deserts and steppes; we hear about "the yellows' intense procreation"; about "yellow masses in the Far East," and we are reminded of the proclamation: "Peoples of Europe, Preserve Your Holiest Goods!" None of this is conducive to creating the image: roughly as many "yellows" as "whites."

On the picture panel one figure signifies 100 million people. Many statisticians are aghast at such rough approximations that graphically capture only figures of no less than 25 million at best. Rounded up, a figure representing 25 million may, if need be, represent 13 million. Meanwhile groups of fewer people, 10 or 5 million, are swept under the table completely.

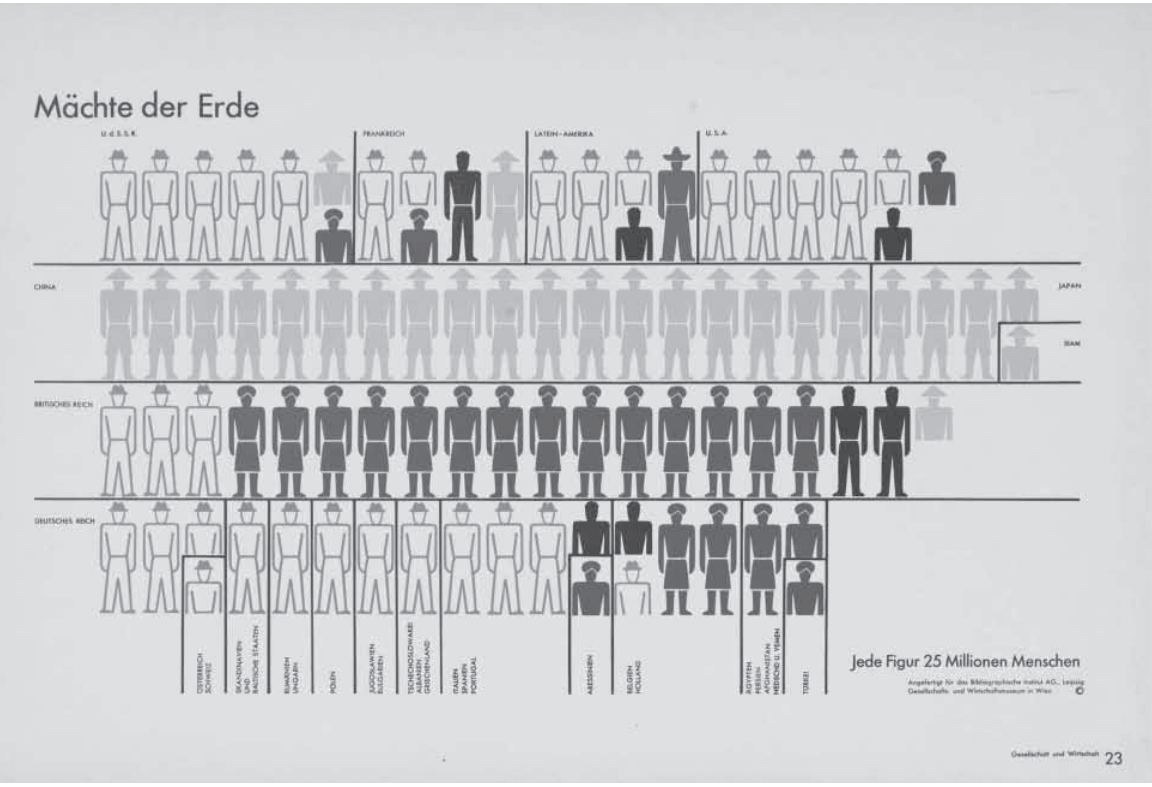
The critical supporters of precision forget that even in *cartography* there is simplification based on the chosen scale—only bad cartographers apply scale proportionally—and that as a pedagogue, a good cartographer reduces scale not automatically, but based on semantics; these strident critics forget that the average person constantly makes mistakes of much larger dimensions. We, the representatives of the "*Vienna Method*," on the other hand, take the position that *it is better to memorize simplified images of numerical quantities than to forget more precise numbers*.

We just conceded in all frankness that during the process of rounding down difficulties may arise. Any experienced pedagogue will be thinking of the tricks that can be used to overcome such difficulties. For it should be clear that the "Vienna Method," unlike other traditional graphic methods, is not an apparatus that turns series of numbers into quantitative images. The "Vienna Method" presupposes *creative pedagogical work*. You attain pedagogical effects through simplifications, through highlighting. *The one who best understands what to omit is the best teacher.* This is true even in those cases where the student has to teach himself. The pedagogue's task is to avoid detours that take up too much time, as well as the provision of suitable educational tools.

Not every numerical quantity is conducive to being represented. It is therefore not advisable to present the learner with too many quantitative images. We have to protect ourselves from overloading our memory. It would be a grave mistake to replace tedious series of numbers with equally tedious, unwieldy series of drawn humanoid figures.

The capable pedagogue will choose suitable *quantitative images* as a *departure point* for comparative analysis. For instance, how many issues are raised if we place panels such as The World's Ethnic Groups, Economic Models and Religions from the folder "Society and Economy" (Bibliographical Institute Leipzig Publishers) next to each other. The student's active task consists especially in *analyzing* the quantitative images; after all, geographical maps are also not created by those who study them, much less the representations of plants or the stuffed animals in a zoological collection.

The quantitative images are as it were the objective correlatives from the sociological collection. The students should be familiarized with these representations of social facts. Experience shows that the care we extend to these depictions cannot be great enough. Teaching aids that stimulate



Gerd Arntz/Otto Neurath, *Mächte der Erde*, 1930. Detail from *Gesellschaft und Wirtschaft. Bildstatistisches Elementarwerk*, Leipzig: Bibliographisches Institut, 1930. Image courtesy of Gerd Arntz, c/o Pictoright Amsterdam 2016.

activity and help with successful *self-study* are of such importance that their producers carry great responsibility. In part this corresponds with certain principles of the Montessori method. *The production of quantitative images by the students themselves takes second place.*

The quantitative images have to be produced in such a way that certain *conventions* make them easier to grasp. In this way all the serial visualizations presented at the Museum of Society and Economy in Vienna begin, in the spirit of written texts, in the upper left corner and end in the lower right. From the observer's point of view, proximity equals the present, while distance is also temporal distance. The arrangement of structured columns to the right and left of a middle axis, among other things, heighten the impression created by comparable panels.

Just as students may themselves create sketches of maps and small reliefs even though they pursue geography with the help of good atlases

whose maps were drawn by good pedagogues, those learning the Vienna Method may *produce* quantitative images even where they do not create what is being taught in a sociology lesson.

Good quantitative images supplement each other to form a system. *Like objects are always represented by like symbolic forms and colors.*—A critic from Sweden has called this a "Renaissance of Hieroglyphs." Even relatively small changes can shift the pedagogical effect of a quantitative image considerably.

The production of quantitative images at school can be successfully accomplished even by the youngest (5–9 years old) in all kinds of ways. They draw rows of figures, stamp them using potatoes, cut out figures and glue them next to each other. Not in every case will the "statistical fact" come to the fore. If the task is to compare children who spent their Sunday outdoors to those who spent Sunday in town, an amazing child may well draw the group of kids who are outside numerically correctly, as climbers between the branches of a tree. In this early period the child's competence in the area of symbolic representation is often remarkable.

As is to be expected, at higher levels, the images are often excessively overloaded with detail. The imitation of known images plays an increasing role. We recommend that at this stage quantitative images should be *composed* of *readymade elements*.

To this aim, the Museum of Society and Economy in Vienna has produced combinable signs from which the wall displays and sketches for the museum's publications are being composed.

The innovative *magnetic displays* at the Vienna Museum for Society and Economy are designed especially for the purposes of group instruction. These are iron tablets to which signs tied to permanent magnets adhere due to magnetism. If you wish to demonstrate cartograms containing statistical data it will be enough to fasten a map drawn on paper to four magnets on the iron tablet. It is possible to place the iron signs on the piece of paper because their magnetism is strong enough. The *magnetic cards containing data* are very suitable for adding an optical dimension to *history lessons* and especially for showing changing quantitative fluctuations without using technically imperfect chalk.

The "Vienna Method" disposes of a range of innovative instructional aids of which we have mentioned a few. *They accompany individuals from their 4th or 5th year and during the period of adult instruction.*

Trials among a group of Montessori children who were supplied with a magnetic card yielded interesting results.

An *interest in faraway countries* exists in children from a very early age. Life in the planisphere with its inhabitants and products becomes a substitute for the tales from 1001 Nights. More generally we can say that pictorial statistics are particularly suited for *representing great opposites*. The English can be visually distinguished more plausibly from the Japanese than, for instance, the English from the French. The tropics can be more easily differentiated from Central Europe than the latter from Eastern Europe.

However, in the area of *quantities*, too, *large*, though not overly large, *fluctuations* are best captured through pictorial statistics. Fluctuations such as 6, 8, 5, 2 are more accessible to the eye than fluctuations such as 106, 108, 105, 102, or 680,000, 5,000, 200.

In this way pictorial statistics pushes toward the representation of great contrasts, great fluctuations; it educates humanity to *survey facts on a grand scale*. In this way the eye assimilates what is essential swiftly and with great confidence.

IMAGE-BASED PEDAGOGY

In any case, pictorial statistics are eminently useful as a supplement to traditional teaching methods. It may be expected that they will become an essential part of a *image-based pedagogy* whose development we are witnessing.

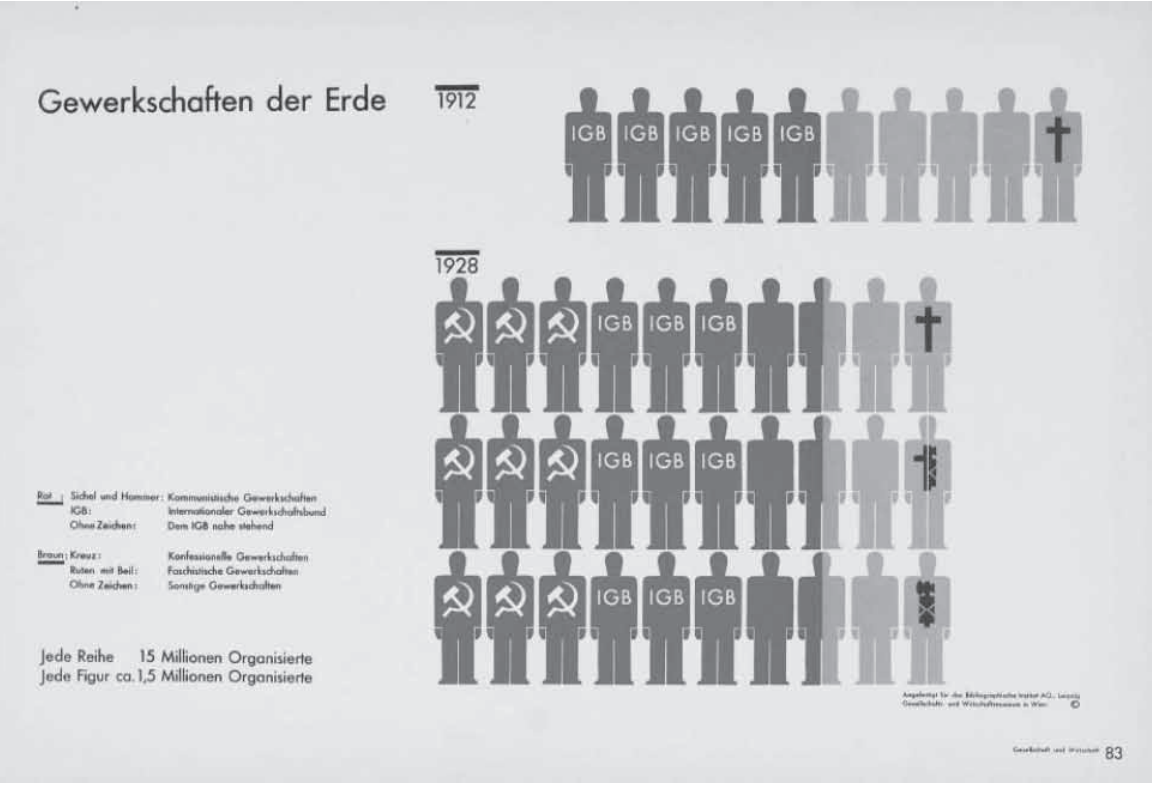
Modern man is first of all an *ocular being*. Advertising, the educational billboard, cinema, illustrated newspapers and magazines are broadly responsible for the education of the masses. Even those who read many books are inspired more and more by images and series of images. When we are tired we may still quickly take notice of something in an image that we would be unable to assimilate through reading.

Beyond that, *image-based pedagogy is a means to open otherwise unattainable educational possibilities for less educated* adults who tend to be more susceptible to optical stimulation, and for *disadvantaged youth*.

The experience in national education shows that through pictorial statistics based on the Vienna Method, knowledge and an understanding of how things connect are spread *without the feelings of inferiority* experienced by students when they confront piles of words they are

unable to master. This is why pictorial statistics is so desirable, especially also for less gifted or less educated children. They gain the impression that they are able to handle social formations like units found in a construction kit. Beyond the results of polls and individual psychological experiments we will probably soon have access to more precise material.

Experimental schools in Vienna and Berlin are now beginning to orient their instruction broadly—to the extent that this is possible already—toward pictorial statistics and image-based pedagogy. It is evident that pictorial statistics are very useful for helping *instruction focus*. [. . .] In terms of contents, pictorial statistics bring much inspiration, yet they may equally lead us into the realm of mathematics and graphics.



Gerd Arntz/Otto Neurath, *Gewerkschaften der Erde*, 1930. Detail from *Gesellschaft und Wirtschaft. Bildstatistisches Elementarwerk*, Leipzig: Bibliographisches Institut, 1930. Image courtesy of Gerd Arntz, c/o Pictoright Amsterdam 2016.

We should, however, be careful not to view pictorial statistics only as a supplement to regular instruction, for example as a reservoir that supplies material for lessons in arithmetic, or as an illustration of certain operations. Pictorial statistics go beyond such visual simplification of math teaching that has been advocated by many. *They can communicate visual information that can be dealt with arithmetically only much later.*

An example: We are learning that six-year-olds, even younger children, are capable of comparing "relative distributions" without much difficulty (for example, they can distinguish a room containing two figures from a second one, containing three) even before they are capable of arithmetic division and of establishing relationships between the quotients of different surfaces and figures. It is surely opportune to take advantage of such optical precocity to visually acquaint the students, in this and other areas, with problems they will be able to master fully only later through arithmetic and logic.

This, however, means in a certain way to turn away from primarily scholastic traditions focused on *words* and *concepts* that often goes against an empirical perspective, while image-based pedagogy favors empiricism. Pictorial statistics operate from the onset with *spatiotemporal formations* while in verbal language we have the possibility of using *combinations devoid of meaning* that we can eliminate only with difficulty.

Yet even those who do not consider the possibilities inherent in an image-based pedagogy essential will acknowledge its importance for *national education* and *schooling* based on the experience we have gathered with pictorial statistics following the "Vienna Method."

Finally it should not go unnoticed that image-based pedagogy, especially pictorial statistics, has international relevance. Words carry more emotional elements within themselves than images based on quantities; these can be assimilated without demur by people from different countries or parties; *words divide, images connect*.

In addition, a large part of humanity is not yet using one of the great Western languages. Once these *illiterates* (in the sense I mentioned) learn Western languages and, through this, the functioning of complex social formations within foreign expressions, they frequently lose the innocent stamina they possessed at their primitive stage. A vacuum is created that is difficult to fill. Supplemented by further image material, pictorial statistics and image-based pedagogy with their quantitative images, organizational charts, and cartograms are

capable of capturing the modern world much more immediately and create a *bridge*. Experience with nomadic tribes in Asia who learnt how to read maps relatively quickly points in this direction.

In this way the study of pictorial statistics within the context of grappling with *humanity's profound civilizational problems* is no doubt timely. Pictorial statistics is not only a question of school education but beyond that of the education of mankind.

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