# Some remarks on pictorial statistics

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„and what is the use of a book," thought Alice „without pictures or conversations?"
(Lewis Carroll, *Alice in Wonderland*)

Visualization is one of the most powerful and useful tools in presenting statistical information. Since the days of Florence Nightingale, who used a kind of pie chart to show the correlation between hygiene and lethal diseases in military hospitals, pictorial presentations of statistical data have become more and more important. Today they are nearly ubiquitous. Thanks to *Numbers*® or *Excel*®, nearly everybody can nowadays produce its own column charts, pie charts, or line graphs in 2D or mock-3D.

## Iconic signs

But why are visualizations by means of pictorial representations so effective? The answer seems obvious: Because they so easy to read! But again, why is that so?

Semioticians differentiate between three kinds of signs: (1) indexical signs, (2) iconic signs, and (3) symbolic signs (symbols). An index, sometimes also called a 'natural sign', is connected to the object it stands for in a non-arbitrary, direct way, i.e. physically or causally: 'Smoke means fire'. A thermometer may represent a temperature by the expansion of a fluid.

Symbols, on the other hand, are connected to the things they signify only by convention. Linguistic signs are usually thought to be symbols, because signs as "dog", "chien" or "Hund" refer to canines just by convention.

Icons in turn resemble the entities they signify by possessing some of their visual qualities. A portrait is a picture of a certain person – and therefore an icon signifying him or her –, because it is similar in appearance to that person.

Iconicity and resemblance are closely connected. Our visual system is used to perceive resemblances. That is one of the reasons why iconic (or pictorial) signs are so easily understood. Right from the beginning we learn not only to see what is in our visual field, but also to visually perceive the various things around us and to recognize them in (realistic) pictures as well.

Moreover we often use internal pictures – mental images – in different cognitive processes such as problem solving or text comprehension automatically and unintended.

This is – among other things – one reason why cognitive linguists tend to believe that using pictures that accompany text will support the text comprehension. If the form of the external representation matches the internal form of the mental representation the workload for the cognitive system gets minimized.

But not any kind of picture will do. Especially if one tries to communicate numerical information as in pictorial statistics, there are constraints that should be taken into account.

## ISOTYPE

In the late twenties of the last century the Austrian sociologist Otto Neurath tried to take advantage of the straightforwardness of iconic signs. He invented the "Vienna Method of Pictorial Statistics" (later called ISOTYPE: International System of TYpographic Picture Education) to be used in child, but also in adult education. The prime motive of Neurath was – in the best tradition of democracy – to make information accessible to everybody. Hence one of his main goals was to enable even the uneducated or the illiterate to understand e.g. social interrelations and dependencies via a pictorial representation of the underlying facts. "To remember simplified pictures is better than to forget accurate figures" was one of his famous phrases. And he also was convinced that "words separate, pictures connect", because language can never be free of domination. The challenge was therefore not only to develop some kind of pictorial language, but one that could do (almost) without words. He wanted to come up with a language that could be understood all over the world; independently of national borders and languages, and comprehensible even for the illiterate.

***Fig. 1: Isotypes designed by Gerd Arntz***

The central task for Neurath and his team was thus to transform complex information into a more or less self-explanatory chart.

The most important means for this undertaking were the highly standardized pictorial signs, which formed the "alphabet" of ISOTYPE – the *pictograms*. The german "Gestalter" Gerd Arntz invented and designed most of them. The examples given in Fig. 1 are still 'legible' for us, although some of the icons appear a bit out-dated.

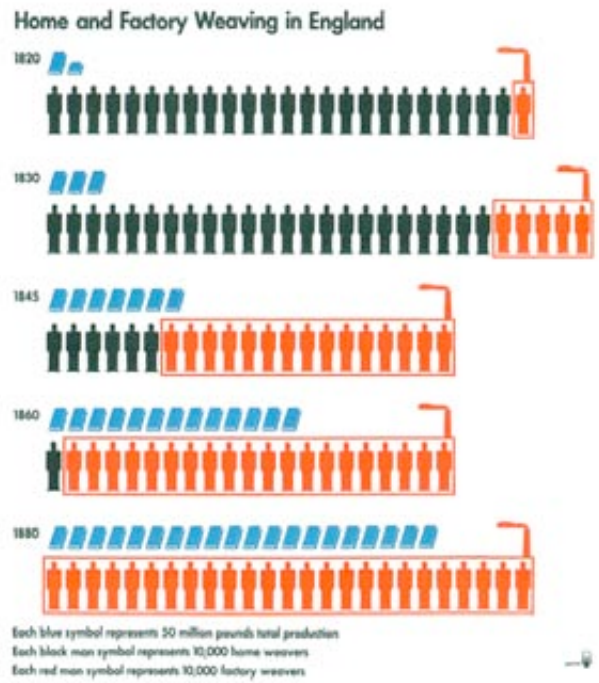


***Fig. 2 Home and Factory Weaving in England***

Many of these signs – partially in a slightly modernized form – are still well known to us, because we see them frequently as pictograms in public places. As can easily be seen, these pictures are both realistic and stylized at the same time.

Neurath was convinced, that a lot of the graphic representations used in texts on statistical facts are misleading because the shapes of the different icons were disproportional and therefore incommensurable. In an ISOTYPE-chart one standardized icon stands for a fixed quantity. A multiple of this quantity has to be represented by repeating the icon accordingly. In Fig. 2 "Home and Factory Weaving in

England" the man-icon stands for 10.000 weavers. In 1845 there are around 60.000 home weavers and 150.000 factory weavers. The blue bale of cloth represents 50 million pounds total production. Thus in 1845 a total production of 355 million pounds is shown. Through the use of icons representing fixed quantities no guessing is needed to see the exact development over the years.

However, ISOTYPE cannot only be used to show statistical relations, but also to demonstrate a sequence of events (Fig. 3).

In Fig. 3 one sees a man suffering from tuberculosis (black icon with rays) who joins the household of a yet uninfected couple (the two white icons). One year later the husband is infected (grey icon), but not diseased. His wife is still healthy. Ten years later the husband and one of his children are ill, his wife is infected. One child is still healthy and one was ill, but is now cured (white icon with the black dot).

This typical sequence of events is shown in such a way, that no medical training is necessary to understand how tuberculosis is passed on. Although the pictures are accompanied by text, they are meaningful by their own virtue.

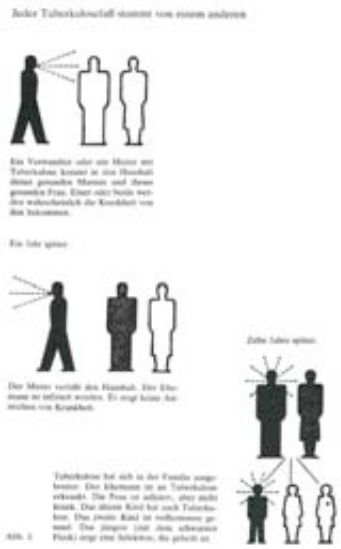

***Fig. 3 The spread of tuberculosis***

## ISOTYPE has not achieved worldwide acceptance

Nevertheless Neurath's ambitious dream of inventing a pictorial language for presenting statistical information, to be used and understood all over the world – independent of the languages spoken in the different countries – has not been fulfilled.

Neurath underestimated the importance of the context and the amount of linguistic information that is needed to get the message of an ISOTYPE-chart. And he also could not foresee that Microsoft's *Excel*® would become one of the most common statistics programs. As a de-facto-standard nearly everybody uses the options for producing charts, diagrams etc. provided by *Excel*®, – and *Excel*® does not provide means for drawing up diagrams the ISOTYPE-way. Still I am convinced that the ISOTYPE-way of representing statistical facts heads in the right direction and that we should rediscover its basic ideas. Even now in the era of computers and the Internet, where pictures and icons are so close at hand, the development of a language independent iconic system with which one can present statistical data in a correct and easy to read way is a goal, which has not be achieved yet.

So, in the first part of my talk I will say a few words about the reasons why pictorial signs are so easily understood and in what way they are connected to visual perception. In the second part I will show how not only Otto Neurath's ISOTYPE, as one of the most ambitious projects in this field, but pictorial statistics in general use the straightforwardness of iconic signs.

## References

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