论信息图形

Talking about information graphics

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| 内容摘要 | 本文着重阐述了在世界全球化的背景下，作为一种有效理解和快速接收的方式，信息的图形化视觉表现成为一种基本的必要手段。从人类交流历史上的初级形式到现在的世界性的视觉语言，信息图形将从早期的发展阶段发展成为具有现代叙事方式的交互信息图形。

|Abstract | The article places great importance on pictural visualisation of information for a better understanding and a faster reception as a basic necessity in our globalized world. Incipient from the history of human comunication to our today's international visual language it will chart the early development stage till the modern way of storytelling in interactive infographics.

[关键词] 信息图形/视觉语言/标志图形
[keywords] information graphics, visual language, signage graphics

信息图形是一种集合信息、数据和知识的视觉表现手段，讨论它的发展过程就像讨论人类的发展过程。在史前文化阶段，原始人创造了最初的信息图形：洞穴壁画（图1）。人们会在任何一种文化中发现，在语句式的表达还没有出现的时期，这些人造图形是在表达人类的思想和情感。接着，图标（象形文字，图2）被用来记录牛和其他家禽、家畜，后来发展成我们的字母形式。现在，看图仍然比识读语句更容易获得信息。图形常常应用在信息需要被快速、简单解释的情况下，例如在标志、地图、报纸杂志、技术论文和教育活动中。为了使概念性的信息交流和扩展的过程更容易，图形作为一种工具被计算机学家、数学家和统计学家广泛地应用在所有科学表现的领域。

一、20世纪视觉语言的发展

1936年，奥地利哲学家、社会学家和政治经济学家奥图·纽拉特（1882—1945）引入一个图形系统作为一种国际性的视觉或图形语

Talking about information graphics or infographics as visual representations of information, data or knowledge is also like talking about the development of mankind. In prehistory, early humans created the first information graphics: cave paintings (pict 1). In every cultural society you will find artefacts expressing thoughts or feelings, but no expression was invented at that time. Later, icons (hieroglyphs (pict 2)) were used to keep records of cattle and stock; our alphabets developed from these. And still it is easier to get the idea from a picture than from a written sentence. Graphics are used everywhere information needs to be explained quickly or simply, such as in signs, maps, journalism, technical writing, and education. They are extensively use as tools by computer scientists, mathematicians, and statisticians to ease the process of developing and for communicating conceptual information, so they are applied in all aspects of scientific visualization.

The development of a visual language in the 20th century

A milestone was the introduction of a system of pictographs intended to function as an international visual or picture language in 1936 by Otto Neurath (1882-1945); an Austrian philosopher of science, sociologist and


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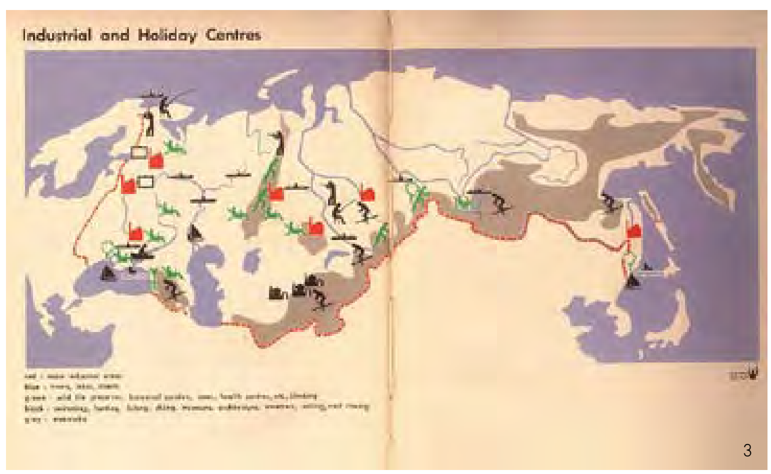

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言，这成为视觉语言发展的一个里程碑。在平面设计和社会学领域，ISOTYPE（可能代表国际印刷图形教育系统的缩写）是用一种以简单的、非语言的方式传达信息的图形系统，由奥图 · 纽拉特和插图画家歌德 · 安纳斯共同设计（图 3）。ISOTYPE 原本是为儿童教育者所设计的，结果却大大地影响了现代公共标志和信息图形的发展。所以我们可以说，纽拉特是世界道路标志系统之父。“一图抵千言”，ISOTYPE 正是这样一种传达数量信息及其社会影响的方式，如不同的国家所拥有的面包和糖的储量，汽车工业中的人力资源情况等。

在国际性的活动中，在那些不同国家的人们聚集的场所里（机场，车站等），人们需要一个通用的导航系统。图形消除了语言的界限和障碍，使交流成为可能。因此不难理解，在 1964 年的东京奥运会上图形被首次应用。Masaru kaatzumie 和 Yoshiro Yamashita 设计了这些图形。但是，8 年以后，在 1972 年的慕尼黑奥运会中（图 4），德国设计师奥托 · 艾舍引用了一套新的图形并总结了制作这些图形的方法：

1. 图形不应该有暗示或者是比喻的特征
2. 应该具有中立的文化立场，应该被不同国家和文化的人理解
3. 不要违反宗教禁忌，不要表现宗教和种族歧视
4. 在认识上应当是中性的，比如人人都能迅速理解其含义
5. 应当易于识别，易于理解
6. 应当用统一的规则或网格来制作图形系统

这些规则现在仍然是有效的，我们可以通过检视我们周围的媒体、印刷品、道路标志和手册中的信息图形来了解这些规则。报纸尽力改用信息图形中的图像化信息来表现天气（图 5），改用地图和位置图来表现新闻事件，改用图形表现原本难于理解的文字形式的统计数据。

二、信息构成

有人说一图抵千言。如果真是这样，仅用一台观测相机来看世界，就能拥有所需要的所有信息。但是，这是不可能的，这也只是第一步。这种监视的方法通常指的是观察并记录随时发生变化的情况，那些收集到的数据还需要分析、解释并表达。这种被称为统计学的数学科学被应用在从自然科学、社会科学到人文科学的多种学科中。（图 6）一个信息图形相当于用千余数据的输入来换取如柱状图、趋势图、散点图、饼状图和分布图的输出结果。信息图形可以让我们识别那些对普通人来说无法承担和辨读的数据。对读者来说，因为以事实和统计为基础，信息图形具有相当于真相和结论的权威性。也正因为如此，各种行业、政府、

political economist). In graphic design and sociology, Isotype (possibly an acronym for International System Of TYpographic Picture Education) is a system of pictograms designed by Otto Neurath and the illustrator Gerd Arntz to communicate information in a simple, non-linguistic way. (pict 3) The original intention of the Isotype was to be used by educators of young children, but wound up having a strong influence on modern public signage and information graphics. So we can also say Neurath is the father of our road signage systems worldwide. In the same way that “a picture speaks a thousand words”, Isotypes are a way of conveying quantitative information with social consequences — the availability of bread and sugar, the manpower involved in constructing automobiles - in different countries.

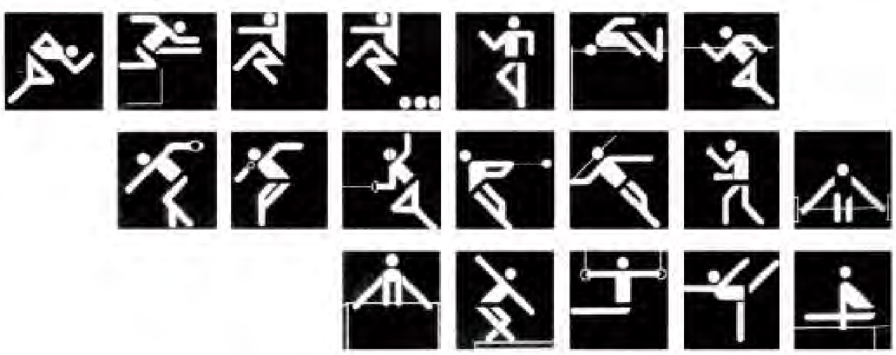
International large events and places where humans from many countries meet (airports, stations etc.), need a common and generally comprehensible navigation system. Pictograms make communication possible by crossing language borders and eliminating language barriers. So it is no wonder why the first pictograms ever, sketched by Masaru Kaatzumie and Yoshiro Yamashita, were used at the Olympic Games in Tokyo 1964. But eight years later at the 1972 Munich Olympics (pict 4) the German designer Otl Aicher introduced a new set of pictograms and summarized his approach to the production of pictograms in general:

• the pictogram shall not have the character of an indication nor an illustration.
• it must be cultural neutral, it must be understood also from humans of other countries or other cultures.
• it may not break taboos, nor represent religious or racist discrimination
• it must be neutral in knowledge , i.e. everybody should understand the meaning immediately
• it must be easy to read and the information easy to understand
• there must be a uniform rule or grid to get a pictogram system.

These rules are still valid and you can realize them by examining the information graphics that surround us in the media, in published works, in road signs and manuals. Try to transform the illustrated information of infographics in newspapers showing the weather (pict 5), or maps and site plans for newsworthy events, as well as graphs for statistical data in text form - that would be unwieldy to comprehend the meaning of the topic.

Structuring information

It is said that a picture is worth a thousand words. If so, you would only have to watch an observation camera and you have all information you need. But that is not true; it is only the first step. This method of monitoring generally means to observe a situation for any changes which may occur over time, and record this. The collected data have to be analysed, interpreted or explained, and presented. This mathematical science called Statistics is applicable to a wide variety of academic disciplines, from the physical and social sciences to the humanities. (pict 6) An informational graphic is worth a thousand data entries if not more and with outputs like histograms, trend lines, scatter plots, pie charts, or choropleth maps. Informational graphics allow us to discern what would otherwise be



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报纸、团体和科学家因为各自不同的原因采用信息图形来表达有力的和似乎是永恒的论点。遗憾的是，信息图形的可操控性是一把双刃剑。毕竟，只有在构成信息图形的信息是真实的和有用的时候，信息图形才会是真实的和有用的。这也是很多信息图形的评论家一直以来关注的问题。

1983 年，耶鲁大学统计学、计算机学和政治学教授爱德华 ·塔夫特所著的具有创造性的《数量信息的视觉表达》改变了这一切。塔夫特认为，信息图形与其说被错误的信息所危害还不如说是被拙劣的和漫不经心的错误表达所危害。《数量信息的视觉表达》和塔夫特后来的一些书以及他个人在图形纠错方面的热心参与引发了关于观察和创造信息图形的方式改革。尽管这本书写在 20 多年前，早于因特网和现代平面设计软件出现，塔夫特智慧的评论在今天仍然是字字珠玑。

三、创新

塔夫特在《数量信息的视觉表达》一书中主要讨论两个内容。一是关于识别信息图形在使用中存在的普遍错误和滥用的情况并指出主要错误所在。二是关于战胜这些错误并发展一个可用于探索提高数据图形的效率和效果的新方法的基本理论。

塔夫特不无愤怒地批评了很多信息图形设计和发布的方式。他尤其痛斥一种普遍存在的认为信息图形仅仅是“枯燥”的统计表的简单替代的观点。“很多人认为”，塔夫特观察说，“图形表达应当使那些发现文字难于理解的观众感受到愉悦和乐趣”。这种对信息和观众的轻视就像是受“归咎于受害人而非罪犯”的做法的影响，并且导致了他称为“图形的平庸”的结果。

图形的平庸是怎样表现的呢？塔夫特指出了一个事实，就是很多设计图形的人有纯艺术的教育背景，而并不熟悉数据分析的知识。这就产生了一些往往是严重曲解或者是掩盖了重要信息的图形创意。在一个众所周知的反面例子中，他展示了纽约时代周刊中的一个表现一桶油从 1973 年到 1979 年的价格增长的图形。（图 7）

数据表明，油的价格从每桶 2.41 美元涨到每桶 13.34 美元，增长率为 454%。这个图形采用按比例的、三维的桶的形式替代了柱状图或趋势线的形式。虽然 1979 年桶的高度比 1973 年的桶高了 454%，但是它的直径也在等量增长。人们在观察图形时会发现 1979 年的桶几乎可以容纳 270 多个 1973 年的桶！

塔夫特在抨击了图形的平庸现象后，接着指出了一系列怎样制作有效图形的原则，他称之为数据图形理论。这个理论主要包括四个方面的

unmanageable loads of data, indecipherable to an average person. Due to their being grounded in facts and statistics, informational graphics have a certain authority of truth and finality for the observer. For this reason, they are used by businesses, governments, newspapers, advocacy groups, and scientists as a way of presenting cogent and seemingly immutable arguments for their various causes. Unfortunately, another parallel aspect of their appeal is their ability to be manipulated. After all, a given graphic is only as truthful -- or useful -- as the information from which it is composed. It was this problem that had traditionally concerned most critics of informational graphics.

Edward Tufte's groundbreaking 1983 book, The Visual Display of Quantitative Information, changed all of that. Tufte, Professor of Statistics, Computer Science, and Political Science from Yale University, argued that informational graphics were not so much compromised by faulty information as they were by poor and inadvertently misleading presentation. The Visual Display of Quantitative Information, along with Tufte's subsequent books and his own passionate crusade for graphical correctness, brought about a revolution in the way that informational graphics were viewed and created. Although he wrote the book before the advent of the Internet or modern graphical software, Tufte's words of wisdom are every bit as relevant today as they were nearly two decades ago.

Innovation

Tufte had two major agendas with The Visual Display of Quantitative Information. One was to identify many of the mistakes and abuses common to informational graphics and to finger the main culprits. The second was to go beyond common errors to develop a general theory of data graphics that could be used to explore new ways to increase their efficiency and effectiveness.

Tufte spared little wrath in critiquing the way in which many informational graphics were conceived and published. First and foremost, he deplored the widespread notion that graphics were only an unsophisticated substitute for “boring” statistics. “Many believe,” Tufte observed, “that graphical displays should divert and entertain those in the audience who find the words in the text too difficult.” This contempt for both the information and the audience had the effect of “[blaming] the victims rather than the perpetrators,” and led to what he called “graphic mediocrity.”

How did this graphic mediocrity manifest itself? Tufte pointed to the fact that many of those who designed graphics were trained in the fine arts and were not familiar with data analysis. This led to graphic innovations that tended to severely distort or conceal essential information within a graphic. In one notorious example, he showed a graphic from The New York Times showing the increase in the price of a barrel of oil from 1973 to 1979. (pict 7)

The data showed the price rising from $2.41 per barrel to $13.34, or an increase of 454%. The graphic used proportional, three-dimensional

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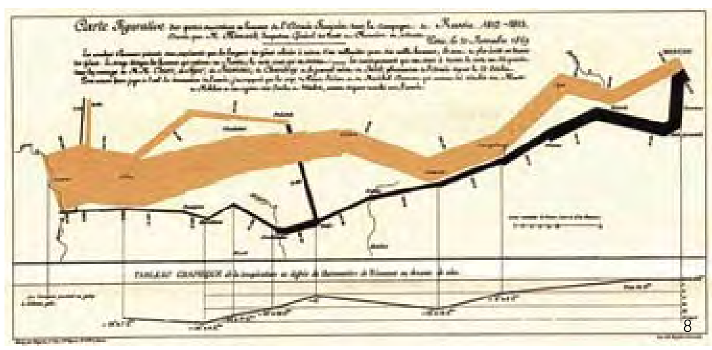

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内容：

1. 消除“图表垃圾”
2. “数据笔墨”最大化
3. 多功能图形元素
4. 高数据密度

这些原则表达了一种在信息图形中成功表现数据的新的思考方式。

塔夫特担心图形的创造者们对展示他们的图形技巧的关注胜过对表现有用数据的关注。这些不必要的花哨的设计内容被定义为“图表垃圾”，它包括很多已经被认为是数据图形普遍特征的一些内容。例如，使用令人迷惑的不同纹理来区分一个图形中的系列数据，结果导致了视觉的“摇晃”，分散了读者的注意力。塔夫特还暗示一直受重用的网格除了分散读者的注意力，对数据几乎没有价值，在一些糟糕的情境中，反而使数据更加难于理解。最坏的使用形式还不仅仅是图表垃圾。塔夫特嘲讽它们是“鸭子”，即指一种以视觉双关特征来抓眼球的建筑风潮，比如汉堡形状的汉堡房和鸭子形状的建筑。鸭子形象地反映了那些用鲜艳的颜色和三维形式打扮得漂漂亮亮的趋势线，使数据看起来更像个过山车而不是严肃地试图传达信息。

图表垃圾的泛滥容易使被塔夫特幽默地定义为“数据笔墨”的内容显得失色，塔夫特用笔墨这个词来形容那些直接传递数据的图表元素，例如区域图中的关键点或者趋势线。图形中图表垃圾的比例越多，数据笔墨的比例就越少（塔夫特称之为数据笔墨率）。为了使图形有效，数据笔墨率应当在合理的范围内尽可能增加。

一个好的图形不仅应当清楚且有条理地表现信息，还应当“调动每一个图形元素，有可能是多次地调用每一个图形元素来表现数据”。人们认为在塔夫特的心目中，1861 年法国工程师查尔斯 ·约瑟夫 ·米纳德绘制的关于拿破仑在俄国的战役地图“可能是目前为止最好的统计图形”。米纳德为了表现拿破仑军队逐渐瓦解的过程，在一个图形中压缩入了大量的信息，如记录位置、方向、时间、数量，甚至温度的信息。(图 8)

最后，塔夫特是高数据密度的支持者。他将之定义为在数据矩阵中的输入量与数据图形面积的比率。当然，这样的比率很难量化，然而，他的观点是清晰的：不要在少量的信息上浪费大量的图形。如果只有少量的数据输入，一个带有文字的表格比创建一个只有几个条状图形的柱状图更合理。

《数量信息的视觉表达》一书改变了人们对信息图形表达的思考方式。今天，网络设计师和印刷设计师熟知塔夫特的理论以调整他们的作品。然而塔夫特的工作还远没有结束。图像设计软件的数据包中仍然包含了过度的添加颜色、网格线以及给二维数据添加额外的视觉维度的选项。最糟糕的是，他们仍然使用塔夫特最厌恶的形式：饼状图。

四、符号学——能指／所指

索绪尔认为，将符号划分在语音式图像和概念中的分类是不明确的。为了使之更明晰，他重新提炼了这个观点，将符号的概念定义为“所指”，而语音式图像定义为“能指”——在信息图形中，这种观点体现为一种将能指与所指结合在一起使之成为我们所谓的标志的努力。

如果一个符号看起来像被其表现的物体，且与物体类似，那么它就

representations of barrels instead of a histogram or trendline. Although the 1979 barrel was indeed 454% taller than the original 1973 barrel, its diameter had increased by the same amount. When looking at the graphic, one sees that the 1979 barrel could contain over 270 barrels from 1973! Other instances included trendlines that lacked contextual information and spending charts that failed to take into account inflationary and population changes.

Tufte's all-out assault on graphic mediocrity segued into a series of principles on how make effective graphics, which he called the Theory of Data Graphics. This theory had four main aspects to it:

1) Elimination of “chartjunk”,
2) Maximization of “data-ink”,
3) Multifunctioning graphical elements, and
4) High data density.

Taken together, they represented a new way of thinking about how to more successfully represent data in informational graphics.

Tufte was concerned that creators of graphics were more concerned with advertising their own graphical cleverness than presenting useful data. These artefacts of unnecessary design flourish were termed “chartjunk”, and included many items that had been accepted as common features of data graphics. For example, often multiple data series on a given graphic were differentiated by a bewildering array of crosshatching variations, causing visual »vibrations« that distracted the reader. Tufte also implicated the venerable grid, which added little to the data but caused distraction, and in worst-case scenarios even obscured much of the data altogether. The worst offenders went beyond mere chartjunk. Tufte derided them as »ducks«, a reference to the fad of building eye-catching structures that served as visual puns, such as hamburger-shaped burger joints and duck-shaped buildings. Ducks often featured trendlines that were spruced up with flashy colours and three-dimensions, making the data look more like roller-coasters than a serious attempt to convey information.

The overuse of chartjunk tended to unnecessarily obscure the use of what Tufte dubbed “data-ink”, namely the ink used in creating the elements of the chart that directly conveyed data, such as plot points or trendlines. The more chartjunk in a graphic, the smaller the proportion devoted to data-ink (what Tufte termed the “data-ink ratio”). To make a graphic effective, the data-ink ratio needed to be increased as much as was reasonable.

A good graphic should not only clearly and neatly present information; it should also “mobilize every graphical element, perhaps several times over, to show the data.”

It is this belief that is at the heart of Tufte's assertion that the 1861 map of Napoleon's Russian campaign, drawn by the French engineer Charles Joseph Minard, “may well be the best statistical graphic ever drawn.” Minard's depiction of space, direction, time, quantity -- even temperature -- in showing the gradual disintegration of Napoleon's army packed an enormous amount of information into a single graphic. (pict 8)

Finally, Tufte was a proponent of high data density. He defined it as the ratio of the number of entries in a data matrix to the area of the data graphic. Of course, such a ratio is often hard to quantify, but his point was clear: don't waste a large graphic on a small amount of information. If there are only a couple data entries, a table within the text makes more sense than creating a histogram with only a handful of bars.

The Visual Display of Quantitative Information changed the way that people thought about the presentation of informational graphics. To this day, web designers and publishers familiarize themselves with Tufte's work in order to fine-tune their works. Yet Edward Tufte's work is far from finished. Graphical software packages still include heavily used features

是图标化的符号。这种符号产生的相似性或类似性会被它的接受者所承认。这是一种最显而易见的视觉符号。例如表现男、女卫生间的符号就是图标化的符号。

引申化的符号引起人们对它所指向的事物的注意。两者之间是具体的、真实的且通常是连续的、具有因果关系的。换句话说，它表现了它所描述的现象之间存在着的关系，例如烟雾是火的引申。

象征化的符号与它所表现的内容没有明显的关系，只有在我们文化中约定俗成的惯例、协议或者规则中才具有联系。这种所指与能指的关系是动机不明的或者是武断的，且需要有一种翻译来建立两者之间的联系。文字、颜色和数字都是象征化的符号。象征化符号的使用是一种文化阐释的形式，认识到这一点是很重要的。

无论是图标化的还是引申化的，惯例对理解任何符号都是必需的。我们需要学会理解图形。惯例是符号的社会维度：它是使用者之间关于符号的恰当使用和反应的共识。

一个道路标志的组成：（图 9）

一个象征化的符号（三角形）意味着“注意”，因为这是我们所公认的含义——这是一种武断的认识，它应该也可以是方形、圆形、八角形，或者是像李子一样的有机形。

一个图标化的符号——看起来像一个正在工作的男人。想一想这在多大程度上是由我们的文化决定的。这也包含一些对工作表现的惯例。

首先，男人工作时使用的是开凿机或手提钻而不是手工来挖掘。

在农村文化中，它可能被认为是一个男人在施肥而不是在进行道路修复。而在女性承担这种辛苦工作的文化中，它可能被认为是一个女人在施肥。

图标是一种能指而且与它们所指向的对象之间有极大的相似性的符号。因此我的照片可以说是高度图标化的符号，因为它看起来像我。一个带有汽车或者摩托车的侧面轮廓的道路标志是高度图标化的符号，因为侧面轮廓看起来像汽车或摩托车。

这里再将元素分类（图 10）

能指	所指
象征性化的白色背景中的红色圆圈	禁止
图标化的香烟	香烟

但是这里还有一个附加的元素——引申化的条状图形。

引申化的条状图形	不能做这件事

我们把条状图形和反对某事联系在一起。有趣的是，这个看起来是

that add colour, gridlines, and extra visual dimensions to two-dimensional data. Worst of all, they still incorporate Tufte's greatest pet peeve of all: the pie chart.

Thinking about signs

Traffic signs and other public signs rely heavily on information graphics, such as stylized human figures (the ubiquitous stick figure), icons and emblems to represent concepts such as yield, caution, and the direction of traffic. Public places such as transit terminals usually have some sort of integrated “signage system” with standardized icons and stylized maps. If we think about visualization information in an infographic we also have to think about to whom it is addressed and is the addressee able to understand the signs we try to use.

Remember the Lasswell's* maxim, “who says what to whom in what channel with what effect,” as a means of circumscribing the field of communication theory.

*Harold Dwight Lasswell (Feb. 13, 1902 — Dec. 18, 1978) was a leading American political scientist and communications theorist.

Semiotics - Signifier\signified

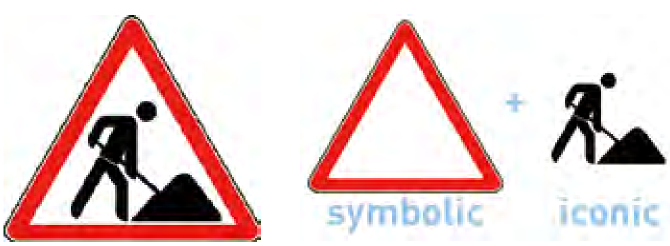
Saussure** actually saw the division of the sign into sound image and concept as a bit ambiguous. So he refined the idea by saying it might make things clearer if we referred to the concept as the signified (signifié) and the sound image as the signifier (signifiant) - this idea is shown in the graphic, which attempts to show how the signifier and signified coalesce into what we call a sign.
**Ferdinand de Saussure (Nov. 26, 1857 – Feb. 22, 1913) was a Geneva-born Swiss; the 'father' of 20th-century linguistics.

A sign is considered to be iconic if it looks like the object signified, bearing a resemblance to its object. The similarity or resemblance proposed by the sign is to be acknowledged by its receiver. This is most apparent in visual signs. For example signs denoting ladies and gentlemen's lavatories are icons.

An indexical sign draws attention to the thing to which it refers. The relationship is concrete, actual and usually of a sequential, causal kind. In other words it signifies the existential relationship to the phenomena it depicts such as smoke which is an index of fire.

A symbolic sign has no obvious connection to the idea it represents except through convention, agreement or rule in our culture that it does. The relationship between signified and signifier is unmotivated or arbitrary and requires the presence of an interpreter to make the signifying connection. Words, colours and numbers are symbols. It is important to note that the use of symbols is a form of cultural interpretation.

Convention is necessary to the understanding of any sign, however iconic or indexical it is. We need to learn how to understand a photograph. Convention is the social dimension of signs: it is the agreement amongst the users about the appropriate uses of and responses to a sign.



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从道路标志中借用过来的符号却和道路标志的用法不同。比如，道路标志表示“禁非机动车”只用一个中间有自行车的红色圆圈来表示；道路标志表示“禁机动车”仅仅用一个红色圆圈来表示。在有些国家也有条状的图形。

五、怎样在平面中表现三维物体或什么是地图？

地图是空间概念的图形化表达或比例模型。它是一种传递地理信息的方法。地图不受语言或文化的影响，它是世界范围内通用的交流媒介，很容易为大多数人理解。将信息融入一张地图的想法，来自于对“快照”概念的理解，即用一张图片表现从常变的地理信息数据库中所选择的某些概念（《麦林词典》， 1996）。

老地图提供了很多关于过去所了解的内容的信息以及地图本身所采用的哲学和文化原则，这些原则通常与现代制图学的原则有很大不同。地图是一种科学家用来发表他们的观点并使之传播后世的方法。(《麦林词典》， 1996）

中世纪，欧洲地图为宗教观念所控制。“T－O”地图处处可见。在这种地图形式中，耶路撒冷被描绘为地图的中心，东方是源方向，并指向地图的上方。北欧海盗在北大西洋的探险发现渐渐被融入 12 世纪初人们对世界的认识中。同时，制图学的发展使那些用来描绘阿拉伯地区包括地中海区域的线条更加可行，更加真实。(图 11）

地图是现实世界的真实表达么？不——永远都不是！测量领域受制于准确度和精确度的误差。由于大气层和观测仪器的过滤，航空摄影和卫星图像只能描绘具有特定光谱的内容。即使是很小的一块地方，也没有地图能描绘其所有物理的、生物的和文化的特征。一个地图只能表现少量的被选择的特征，并且也常常是根据某种分类用高度符号化的方法来绘制的。通过这些方法，所有的地图都是近似的、概括的，是真实地理条件的一种译释。

每种地图投影都有优缺点；适当的投影方式取决于地图应用的比例和目的。比如，一种投影方式在描绘整个国家时可能是带有让人无法接受的变形，但是在大比例地（详细地）描绘一个国家时可能就是一个很好的选择。地图投影的性质也会影响地图的设计特点。有些投影方法对描绘小面积区域而言是好的，有些投影方法对描绘大面积的、东西向的

A road sign consists of: （pict 9）

One symbolic sign (the triangle) which means: “Watch out” because we agree that is what it means – it is arbitrary; it could just as well be a square, circle, octagon, or a plastic model of a prune etc.

One iconic sign – it looks like a man at work.
Think, though, of the extent to which that is determined by our culture. There are certain conventions at work here too.
First of all, the men at work mostly do not dig by hand, they use an excavator or a jackhammer.

In a more rural culture, it could be read as a man shovelling manure, rather than road repair materials. In cultures where woman do such menial work, it could pass for a woman shovelling manure.

Icons are signs whose signifier bears a close resemblance to the thing they refer to. Thus a photograph of me can be said to be highly iconic because it looks like me. A road sign showing the silhouette of a car and a motorbike is highly iconic because the silhouettes look like a motorbike and a car. (pict 10)

Here again, the same sort of elements:

signifier	Signified
The symbolic red circle on a white background	Something is forbidden
The iconic cigarette	Cigarette

But here there is an additional element, the bar, which is indexial:

The indexial bar	You can not do this

We associate with a barrier or with crossing something out. Interestingly, this seems to be quite common on signs which are derived from road signs, though not on road signs themselves. For example, the road sign which means ‘no bicycles’ simply has a bike in a red circle; the road sign which means ‘no vehicles’ simply has a red circle. In some countries has also a bar cross.

How to get 3-dimensions on a flat plane or … What is a Map?

A map is a graphic representation or scale model of spatial concepts. It is a means for conveying geographic information. Maps are a universal

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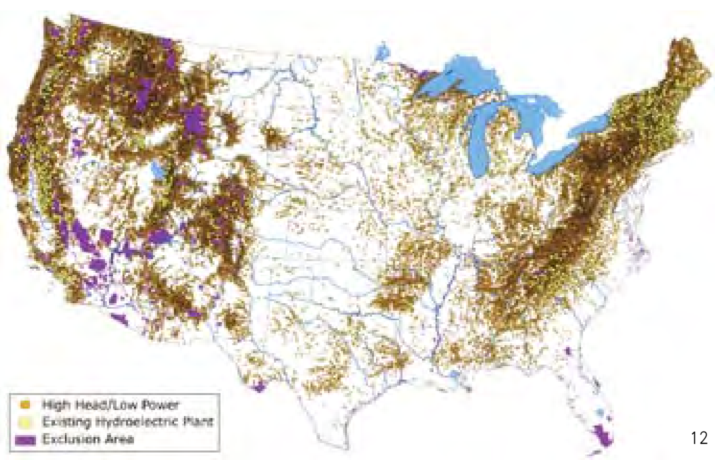

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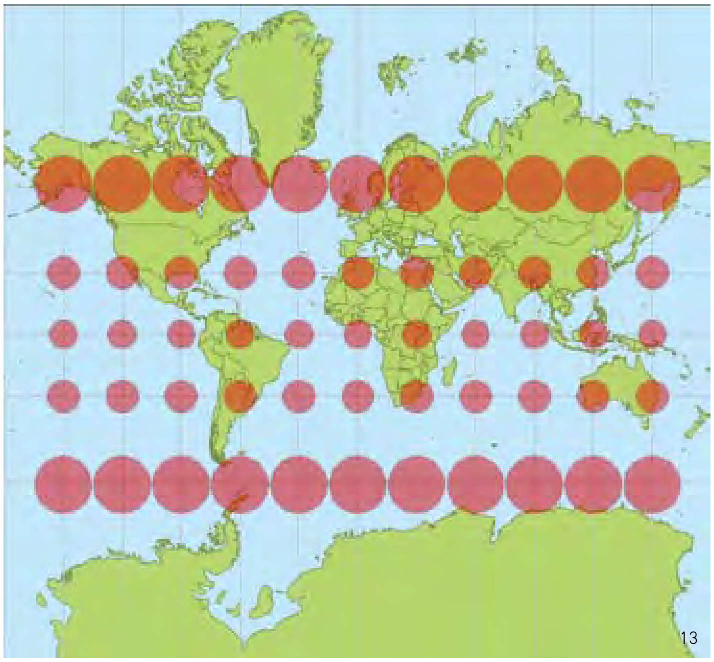

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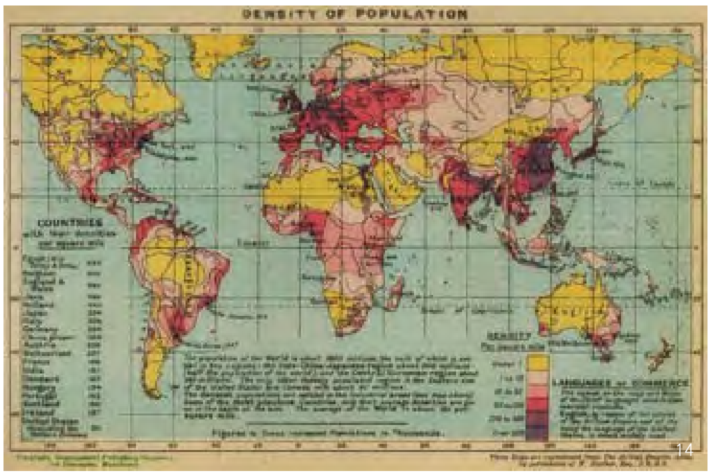

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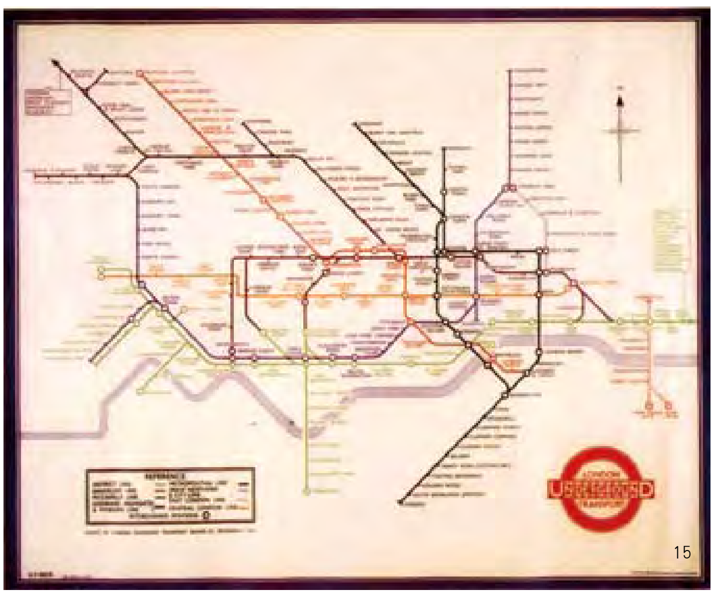

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medium for communication, easily understood and appreciated by most people, regardless of language or culture. Incorporated in a map is the understanding that it is a "snapshot" of an idea, a single picture, a selection of concepts from a constantly changing database of geographic information (Merriam 1996).

Old maps provide much information about what was known in times past, as well as the philosophy and cultural basis of the map, which were often much different from modern cartography. Maps are one means by which scientists distribute their ideas and pass them on to future generations (Merriam 1996).

During the Medieval period, European maps were dominated by religious views. The T-O map was common. In this map format, Jerusalem was depicted at the centre and east was oriented toward the map top. Viking explorations in the North Atlantic gradually were incorporated into the world view beginning in the 12th century. Meanwhile, cartography developed along more practical and realistic lines in Arabic lands, including the Mediterranean region. (pict 11)

Are maps realistic representations of the actual world? No--never! Field measurements are subject to errors of accuracy and precision. Aerial photographs and satellite images portray only certain portions of the light spectrum, as filtered through the atmosphere and detection instruments. No map can depict all physical, biological, and cultural features for even the smallest area. A map can display only a few selected features, which are portrayed usually in highly symbolic styles according to some kind of classification scheme. In these ways, all maps are estimations, generalizations, and interpretations of true geographic conditions.

Each map projection has advantages and disadvantages; the appropriate projection for a map depends on the scale of the map, and on the purposes for which it will be used. For example, a projection may have unacceptable distortions if used to map the entire country, but may be an excellent choice for a large-scale (detailed) map of a county. The properties of a map projection may also influence some of the design features of the map. Some projections are good for small areas, some are good for mapping areas with a large east-west extent, and some are better for mapping areas with a large north-south extent.

Some projections have special properties. For example, a Mercator projection has straight rhumb lines and is therefore excellent for navigation, because compass courses are easy to determine.

Classification based on distortion characteristics

A projection that maintains accurate relative sizes is called an equal area, or equivalent projection. These projections are used for maps that show distributions or other phenomena where showing area accurately is important.

The National Atlas of the United States uses a Lambert Azimuthal Equal-Area projection to display information in the online Map Maker. In addition to its equal-area properties, this projection also shows true directions from the center point of the map. This means that the projection works well for mapping areas that extend equally from the center point, such as North America. (pict 12)

Mercator projection is a projection that maintains angular relationships and accurate shapes over small areas is called a conformal projection. These projections are used where angular relationships are important, such as for navigational or meteorological charts. Examples are the Mercator projection and the Lambert Conformal Conic projection. The U.S. Geological Survey uses a conformal projection for many of its topographic maps. (pict 13)

A projection that maintains accurate distances from the center of the projection or along given lines is called an equidistant projection. These

区域而言是好的，有些投影方法对描绘大面积的、南北向的区域而言则更为妥当。

基于变形特征的分类：

1. 具有相对准确尺寸的投影叫等积投影或全等投影。在地图中，这种投影方法被用于描述区域分布或者那些看重面积准确的内容。在在线地图制作网站中，美国国家地图集使用兰伯特方位角等积投影方法来表现信息。除了等面积的特征之外，这种投影方法也表现了以地图中心点为基准的真实方向。这也意味着用这种投影方法来描绘从中心点等积延伸的区域时是相当不错的（例如北美）。（图 12）

2. 墨卡托投影是具有角度关系和小面积准确形状的投影，也叫等角投影。这种投影方法在看重角度关系的情况下使用，比如导航或者气象图表中。应用实例如墨卡托投影和兰伯特圆锥正形投影。美国地理研究的很多地形学地图都采用了等角投影的方法。（图 13）

以投影中心为基点沿指定线具有准确距离的投影方法叫等距投影。这些投影方法用于无线电和地震测绘以及导航。应用实例如等距圆锥投影和等量投影。方位角等距投影方法被用于联合国的象征图形中。（图 14）

3. 以给定中心点为基准具有准确方向（角度关系）的投影叫方位角投影或等距天顶投影。这些投影应用在航空图表和那些看重方向关系的情况中。应用实例如日晷投影和兰伯特方位角等积投影。

4. 一个投影地图可能混合了上述多个特征，或者是在可接受的限度内对所有的形状、面积、距离和方向属性变形的一种折中。折中应用的实例如温克尔投影和罗宾逊投影，常用于世界地图。

对比我们简化和提炼信息的需要，我们会发现这与我们对地图中具体信息的需要之间的矛盾。但问题是我们是否需要所有的具体信息呢？这也是亨利 · 贝克在 20 世纪 30 年代作为伦敦地铁地图设计师时所面临的问题。伦敦地铁系统十分复杂，几乎不可能把所有的车站适配入标准的卡片牌中。未受制图惯例的影响，亨利 · 贝克将地铁地图设计得像一个电路板，在地图中只使用彩色的垂直线、水平线或者 45 度线，并且根据应用位置来定位车站，同时保证车站之间的相对距离不变。这种地理上并不准确的地图立刻取得了成功，直到今天它仍然提供了一个有条理地观察复杂系统的方法。对于伦敦人来说，它成为他们城市系统化的图像，并且也成为后来全世界城市地图的一个样本。（图 15）

六、制作信息图形的程序

在日常工作的压力和有限时间的情况下，当我们开始制作信息图形时，我们会采用速战速决的策略。我们打开一个应用程序如 Microsoft Office Excel，置入一些数据，选择一个图表类型并接受软件提供的默认设置的一些令人恐怖的颜色。

为了使创建图表的过程容易，这个过程被分为 3 个部分：

1. 用来做什么？

我们制作图形表达的原因。这决定了要收集的数据类型，即我们应当问这些数据是什么类型（数量的、序列的、范围的，等等），而且最重要的是：这些数据和我们想要的内容有关么？

projections are used for radio and seismic mapping, and for navigation. Examples are the Equidistant Conic projection and the Equirectangular projection. The Azimuthal Equidistant projection is the projection used for the emblem of the United Nations. (pict 14)

A projection that maintains accurate directions (and therefore angular relationships) from a given central point is called an azimuthal or zenithal projection. These projections are used for aeronautical charts and other maps where directional relationships are important. Examples are the Gnomonic projection and the Lambert Azimuthal Equal-Area projection.

A map projection may combine several of these characteristics, or may be a compromise that distorts all the properties of shape, area, distance, and direction, within some acceptable limit. Examples of compromise projections are the Winkel Tripel projection and the Robinson projection, often used for world maps.

Comparing this with our need for simplification and reduction of information we will find an incompatibility with our need for details in maps. But the question is: Do we need all the details? This is the same question Henry Beck as the map designer of the Map of London Underground was faced with in the 1930s. The London underground rail system became too complex and it was nearly impossible to fit all the stations into the standard issue card folder. Unimpressed by cartographic conventions, Henry Beck plotted the underground like an electrical circuit board, using only vertical, horizontal, or 45 degrees angled colored lines and locating the stations according to available space, equalizing the distances between stations. This geographically inaccurate map, provides till today a coherent overview of a complex system and is an instant success. For the Londoners it became the organizing image of their city and a prototype for future generations of city maps all over the world. (pict 15)

"The process of making an information graphic"

It appears that the pressure of everyday work and the little time that we have means that when we are about to perform an information graphic we adopt the tactics of immediacy. We start a spreadsheet application like Microsoft Office Excel, throw in some data and select a chart type, accepting the atrocious colours that the Software gives us by default.

In order to facilitate the process of creating a chart:

The process is divided into three parts:

1) What is it for?
The reason why we make the graphic representation. This determines the type of data to gather and about which we have to ask what type it has to be (quantitative, sequential, categorical, and so on) and more importantly: are they relevant for what we want?

2) How?
In what way we will represent the data. A fundamental aspect of this section is that information graphics are interesting because they reveal differences. For this reason refining them and representing the data derived from their statistical treatment often reveals aspects that otherwise would result confusing. Once data is refined we have to choose the most effective visual metaphor. Sometimes, for a little data, a table or even a sentence can be clearer than a chart. In certain occasions changing the colour palette or the type of chart can clarify the situation enormously.

3) Does it work?
We can obtain a nice and elegant chart but, if it does not fit the goal that we have defined in the first step, we will have failed. The key resides in revising and experimenting with what we have done until we find an improvement.

2. 怎样做？

我们表现数据的方式。这部分的要点是信息图形应该有趣，因为它们揭示差别。因此，从统计对象中提炼和表现数据常常能够使那些会导致混乱的内容变得更清晰。数据一经提炼，我们就应选择最有效的视觉隐喻。有时，一个表格甚至是一个语句比图表更能清晰地表现一个小数据。在一些特定的情况下，改变图表的颜色就能大大地使情况变得明晰。

3. 它起作用么？

我们可能会得到一个漂亮、雅致的图表，但是如果它和我们最初定义的目标不一致，我们就会失败。关键在于修改、测试已经完成的内容，直到找到改进的方法。在不丢失相关信息的情况下，变换颜色，降低次要内容的饱和度，提高最有关联的数据的饱和度，调整版式和字体的大小，删除对表现和明晰数据没有用处的内容等，有时会显著地改善效果。

最后，制作一个好的信息图形在于使对复杂内容的理解变得更容易，而不是使简单的内容复杂化。如果不能清楚地理解什么是我们追求的目标，谁是我们的观众，如果没有大量的工作和思考，我们就无法作出好的信息图形。

正如文章开始所说，信息的视觉化是数据研究和表现假想结构的传统工具，它根植于科学的推理，而且传统上被认为是意义建构的分析工具。但是对那些难以用一个图表或者分解图去表现的复杂的内容，我们就应当改变记者式的叙事方式，从静态的、单向的印刷媒体转向电视或者因特网上的计算机图形的主流（图16）。这使交互式的图形变得必要。信息图形中的交互可能由一个简单的动画开始，直至可以让观众参与或让他们来改变信息以适合他们的要求和愿望。用交互信息图形的先驱阿尔伯特·凯洛（www.albertocairo.com）的话来说，多媒体“可能会成为未来信息图形中最重要的因素，而在在线的信息图形中好的多媒体实例并不多见”。1990年以来，信息图形的迅速发展是和因特网的发展联系在一起的，快速的图形计算机和不断发展的网络新闻市场使动画的视觉表现形式成为可能。这也意味着在优秀的新闻报道中，有广阔的领域去探索使用（信息）设计工具插图、制图和加入了视频、音频、交互摄影的方法。报纸行业的竞争是在同一个城市，甚至是同一个国家范围内的竞争，在线的信息图形和报纸不同，其竞争的范围是欧洲其它（同种语言）国家或者是大洋彼岸的国家。因为读者可以自由地随处选择令他们感兴趣的内容，所以他们会选择最好的信息图形。如果设计师想抓住读者，他们必须努力保持稍稍领先于他们的竞争对手的优势。再一次用阿尔伯特·凯洛的话来说，就是成为“未来因特网时代信息图形领域”的“弄潮儿”。

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纽约字体设计协会会员，德国Munchen印刷协会会员

Varying the colours, reducing the saturation of what is less important and increasing it for the most relevant data, modifying the typography, the size of fonts, eliminating everything that does not contribute to showing and clarifying the data (irrelevant grids, redundant data, unnecessary labels) without losing relevant information sometimes provides surprisingly improved results.

In the end, making a good information graphic consist of facilitating the understanding of complexity, instead of complicating what is simple. And this cannot be achieved without the clear understanding of what goal we pursue, who our audience is and a good deal of work and reflection.

As we started, information visualization is traditionally a tool for data exploration and hypothesis formation, its roots are in scientific reasoning and traditionally it has been viewed as an analytical tool for sense-making. But what if the topic is too complex to be drawn in one chart or an exploded view. You have to change your way of storytelling as a journalist, from static, non interoperable printed media to the mainstreaming of computer graphics on the Internet or in TV. (pict 17) This necessitates interactive infographic. It could start as a simple animation as far as interactivity in the infographic that lets the readers play or lets them transform the information so it will fit their needs or desires. Multimedia “is probably the most important key for the future of infographics and there are not many examples of good multimedia in online infographics out there.” quoting Alberto Cairo (www.albertocairo.com), one of the pioneers of interactive infographics. The phenomenon of the rapid development of infographics since 1990 goes together with the growth of the Internet and the possibilities of animated visual explanations due to fast graphic-computers as well as the growing Internet news market. This also means there is a wide field to discover in excellent news reporting using the tools of (information) design, illustration, cartography and/or photography adding video, audio and interactivity. The competition in on-line infographics is not like the newspaper examples with the colleagues from the same city, or even from the same country – no, it is a competition between other (same-language-speaking) countries from Europe or the other side of the ocean. The readers will choose the best, because they are free to take from here and there what interests them. If designers want to hang on their readers, they must make every effort to stay a little bit ahead of their competitors. Quoting Alberto Cairo again: This is meant by sailing close to the wind to the future of infographics in the internet era.

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