

HAZARD zones



DEPTH in kilometers



Infographics & Data Visualizations

信息可视化设计

王凯 / 编 贺丽 / 译

辽宁科学技术出版社

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Contents 目录

004 Foreword 前言

007 Classification of Infographic Design 信息可视化设计的分类

Types of Infographics

信息设计的类型

Data Chart
数据信息设计

Illustration Chart
插图信息设计

Map Chart
地图信息设计

Visual Effects of Infographics

信息设计的视觉效果

Two-dimensional Infographics
二维平面

Three-dimensional Infographics
三维立体

Design Language of Infographics

信息设计的语言

Vector
矢量

Realistic Graphics
写实

Hand Drawing
手绘

Cartoon
卡通

Photography
摄影

006 History of Infographic Design 信息可视化设计的历史

017 Interpretation of Infographic Design 信息可视化设计的解读

Data Visualization

数据可视化

Illustration Visualization

插图可视化

028 Techniques of Infographic Design

信息可视化设计的方法

Information Framework and Mind Maps

信息框架和思维导图

Concept of Mind Maps Drawing Basic Mind Maps Mind Map Cases
思维导图的概念 思维导图的创建方法 思维导图实例

Data Processing and Research

数据整理和调查研究

Data Filtering Positioning Analysis of the Target Audience
筛选数据 受众对象的定位分析

Storyboard and Information Compaction

分镜头语言和信息精简

Storyboard Information Compaction
分镜头语言 信息精简

Design Style and Graphic Symbols

设计风格与图形符号

Design Style Graphic Symbols
设计风格 图形符号

Colour and Text Scheme

色彩与文字方案

Colour Scheme Text Scheme
色彩方案 文字方案

076 Case Studies

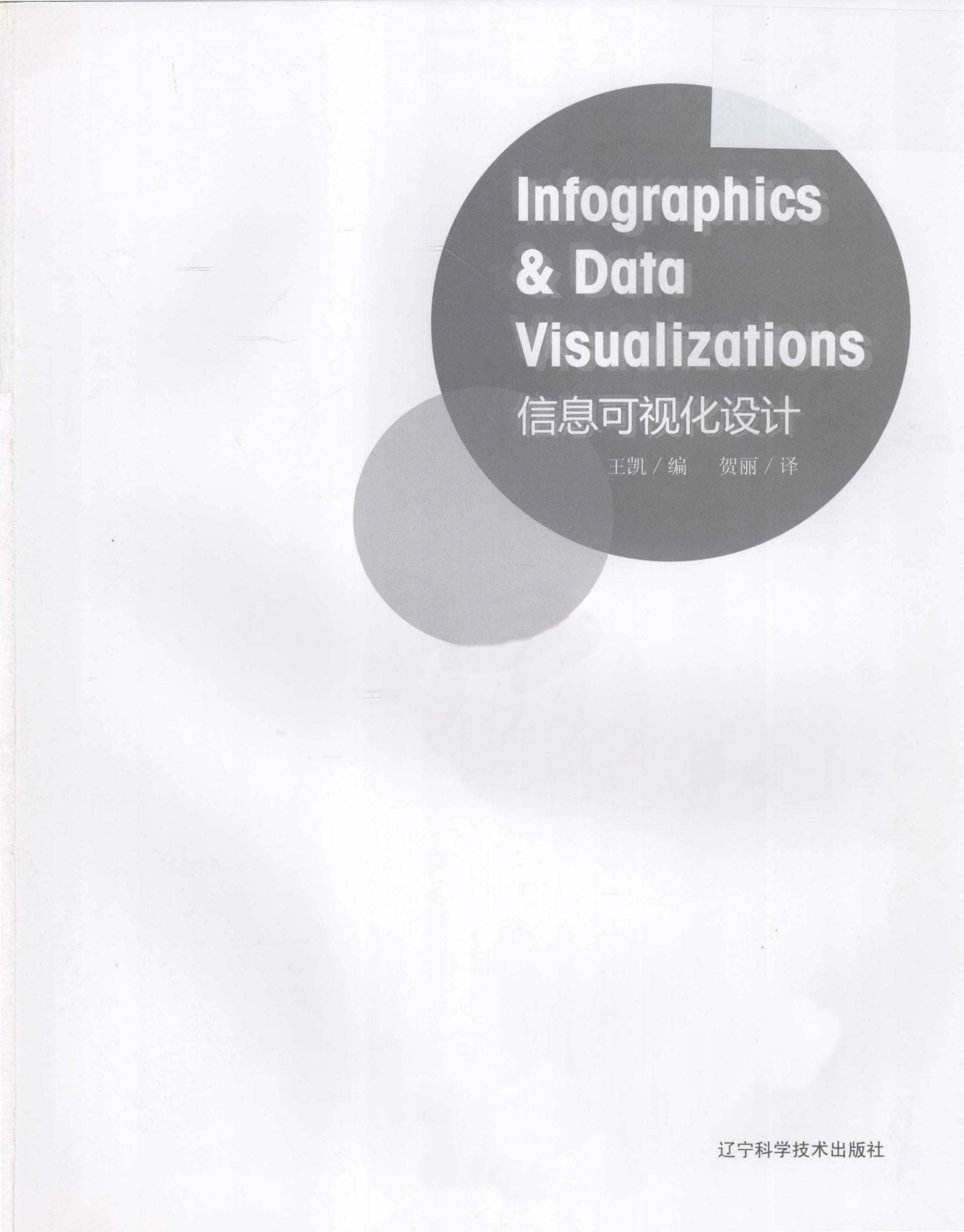
案例分析

Business & Economy 商务和经济	Accident 事故	Environment 环境	
Transportation 交通	Travel 旅游	Lifestyle 生活	
Education 教育	Science & Technology 科技	Politics 政治	
Entertainment 娱乐	Sports 体育	Health 健康	Others 其他

074 Future of Infographic Design

信息可视化设计的未来

350 Index 索引



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Contents 目录

004 Foreword 前言

007 Classification of Infographic Design 信息可视化设计的分类

Types of Infographics

信息设计的类型

Data Chart
数据信息设计

Illustration Chart
插图信息设计

Map Chart
地图信息设计

Visual Effects of Infographics

信息设计的视觉效果

Two-dimensional Infographics
二维平面

Three-dimensional Infographics
三维立体

Design Language of Infographics

信息设计的语言

Vector
矢量

Realistic Graphics
写实

Hand Drawing
手绘

Cartoon
卡通

Photography
摄影

006 History of Infographic Design 信息可视化设计的历史

017 Interpretation of Infographic Design 信息可视化设计的解读

Data Visualization

数据可视化

Illustration Visualization

插图可视化

028 Techniques of Infographic Design

信息可视化设计的方法

Information Framework and Mind Maps

信息框架和思维导图

Concept of Mind Maps

思维导图的概念

Drawing Basic Mind Maps

思维导图的创建方法

Mind Map Cases

思维导图实例

Data Processing and Research

数据整理和调查研究

Data Filtering

筛选数据

Positioning Analysis of the Target Audience

受众对象的定位分析

Storyboard and Information Compaction

分镜头语言和信息精简

Storyboard

分镜头语言

Information Compaction

信息精简

Design Style and Graphic Symbols

设计风格与图形符号

Design Style

设计风格

Graphic Symbols

图形符号

Colour and Text Scheme

色彩与文字方案

Colour Scheme

色彩方案

Text Scheme

文字方案

076 Case Studies

案例分析

Business & Economy

商务和经济

Accident

事故

Environment

环境

Transportation

交通

Travel

旅游

Lifestyle

生活

Education

教育

Science & Technology

科技

Politics

政治

Entertainment

娱乐

Sports

体育

Health

健康

Others

其他

074 Future of Infographic Design

信息可视化设计的未来

350 Index

索引

Foreword 前言

This book explores various ways of thinking and design of the information visualization, and here, we will talk about the relationship among information, thinking, design and art.

About Information:

Since we are social beings, we have to adapt to the environment, not vice versa. This is the social rules of survival that we have learned since we began to understand the world. Understanding what is happening in the world, grasping the development trends and working hard to keep up with the development have become our required courses. Hence, every morning when we wake up, we will involuntarily turn on the radio, TV, mobile phone, computer and link to the Internet. Then, all kinds of information are coming. Regardless of our real needs, they have directly hit our minds, occupied our remaining spare time and forced us to think along with them. At this moment, thinking has become very extravagant, because there is little time for us to see, let alone to think, and the problem of "information overload" has become the biggest challenge we must face. At this time, the information visualization design comes into being and thus comes the purpose of this book: we try to take advantage of this "global visual language" from the information world to make a deep analysis on the whole thinking process of information visualization and provide various methodologies to simplify and visualize the complex information, helping people obtain wisdom from the information and thus win the information war in the future.

About Thinking:

Since media spaces in the information age have been greatly inflated, we are forced to use the simplest language as much as possible to communicate with others, and then to learn thinking; while to link thinking with information and clear off the invalid information will become an important way of life in the future. Ways of thinking based on information visualization will be the tendency of the future world, which encourages us to study the relationship between brain and thinking, grasp methods of data analysis, and learn to tell stories as well as create art or design, additionally, to completely express all information in a picture. Hence, it is necessary to integrate sensibility with rationality in the process of streamlining text, macro-controlling design ideas and objectively treating the results of the information transfer.

In the whole process of information visualization design, methods and processes are cores of the information-based thinking. Just as the book refers, we firstly divide the design work into three categories and equip each of them with explanatory texts; and then try to apply the two simple methods of "positive" and "reverse" to analyse the core and design process of the information design project as the following: firstly, we will reversely illustrate the visual design works and decompose it step by step to get the original content; secondly, it is better to positively divide this information design project into five available steps, which are "information framework and mind maps", "data processing and research", "sub-lens language and information compaction", "design style and graphic symbols", and "colour and text scheme". The last step is to refine the design method and employ abundant examples to provide a good way to thinking and designing of the information visualization project.

About Design:

Information visualization design is a special discipline that crosses multiple industries with great value of application. Its entire process of thinking and designing contains the language of narrative analysis. When designing the information visualization based on visual image and story plot, the first step is to follow the "mind maps" to design a number of story lines and describe the information with the spatial network structure that is closer to human thinking and then to accurately list the needed contents; the next step is to create the corresponding sub-lens language according to the different clues and levels, which refers to converting the text into visual image, building the entire logic of the framework and controlling the progress and rhythm, so as to encourage the reader to link the visual symbols with the information content naturally, quickly grasp the basic meaning and conceptual logic of the project and finally get the complete content of the information.

About Art:

The visualization design of information is not just as simple as the "information+image". It needs to centre on the information content and be carefully observed, analysed and supported with creative ideas to illustrate the content in the manner of narration. What's more, a perfect way of artistic expression will fill it with a sense of art and make it more appealing and

connotative. However, the most difficult part in this process is to deal with the conflict between the sensible art creation and the rational logical thinking and make them go harmoniously with each other. The information content has limited the free artistic creation but given the whole artistic process of information design a sense of challenge, which encourages designers to innovate and create distinctive and exclusive works.

In the world of information visualization, information has interwoven with thinking, design as well as art, which is not a trend in a period or phase but will be the future.

Wang Kai
2012 July, Shanghai

这是一本分享信息可视化的思维与设计方法的书，在这里，我们将谈一谈信息、思维、设计以及艺术。

关于信息：每个人都是社会的人，我们要适应环境，而不是让环境适应我们。这是我们从懂事开始就不断被教导的社会生存法则。而了解世界上正在发生的事情，掌握世界动态，同时，不断努力工作学习与时俱进，则成了我们每天的必修课。于是，当我们每天早晨从睡梦中醒来睁开双眼时，便会不由自主的打开收音机、电视机，敲响手机，启动电脑，链接上英特网。就在这个瞬间，0.001秒，我们便遭遇了信息轰炸，各种信息如同暴风骤雨般袭来。它们不管我们是否需要，都一股脑的直击我们的心灵，占据仅剩的闲暇时间，逼迫着我们的思维随之而游走。这时，思考，便成了一件极为奢侈的事情，因为我们根本来不及看，更来不及想，“信息过剩”成了我们必须面对的最大挑战。就在此时，信息可视化设计诞生了，撰写此书的目的也随之而来：我们尝试利用这门刚诞生于信息世界的“全球通用视觉语言”，对信息可视化的整个思维过程做一个深度剖析，并使大家学会将复杂的信息条理化、简单化、视觉化的实用方法，从信息中获得智慧、创造价值，在未来的信息之战中赢得胜利。

关于思维：信息时代的媒体空间极度膨胀，这逼迫我们尽可能用最简略直白的语言与人交流，学会思维成为了一件我们不得不面对的事情；而将思维与信息挂钩，同时又用批判的眼光将思维与无效信息剥离，将成为我们最重要的未来生活方式。信息可视化思维方式是未来世界的发展趋势，它使我们不得不钻研大脑与思维的关系、了解数据分析方法、学会讲故事，擅长艺术和设计创作；同时，又将所有的信息内容在一个画面中完整的表达出来。因此，精简文字，并宏观的掌控自己的设计思路，客观的看待作品的信息传递成效，感性与理性缺一不可。

在整个信息的可视化设计过程中，信息思维的方法和过程是核心。就如同书中所说，我们先将设计作品分成三个类别，并分别做了概念性说明，然后尝试用简单易懂的“正向”、“逆向”两种方法分析信息设计作品的核心内容，以及创作过程：先逆向解读视觉设计作品，将其一步步拆分为最为原始的文字信息内容；又正向的将信息设计分解为“信息框架和思维导图”，“数据整理和调查研究”，“分镜头语言与信息精简”，“设计风格与图形符号”，“色彩与文字方案”五个极具可操作性的设计步骤，将创作方法提炼，同时辅以大量实例，为大家推荐一条信息可视化的思维与设计捷径。

关于设计：信息可视化设计是一个横跨多个行业领域的特殊学科，同时，又是一个极具应用价值的设计门类。它的整个思维和设计过程都包含着叙事性分析语言。信息可视化必须在拥有视觉图像与故事情节结构的同时，先通过“思维导图”这个步骤设计出多条故事线索，用更接近于人类思考的空间网状结构来描述信息，并将所有需要展示的内容准确的罗列出来；然后再针对不同的线索和脉络层次创作其对应的“分镜头语言”——按故事中的段落情节，将文字转换成视觉形象，构架故事的整个思维逻辑，并控制发展进度和节奏，使读者能在阅读时轻松的将视觉符号与信息内容自然而然的关联在一起，并能快速解读作品的基本含义、概念逻辑等，从而完整的了解设计师所要传递的信息内容。

关于艺术：信息的视觉化设计不仅仅只是“信息+图像”那么简单；它需要以信息内容为核心，先通过细致的观察分析，理清思路，再运用巧思和个性创作，将其用叙事方式讲述出来，同时辅以艺术化的表现手法，创作出既有强烈视觉效果，又极富信息内涵的设计作品。而这其中，最难的地方便是感性艺术创作与理性逻辑思维的冲突、协调和统一。信息内容给自由艺术创作带来了一定的限制，而这也使信息设计的艺术化过程变得极具挑战性，更刺激设计师们不断自我突破，创作出超越自我，并极富个人魅力和风格的设计作品。

在信息可视化的世界中，信息、思维、设计、艺术穿插交织在了一起，你中有我，我中有你，它不是某个时期或阶段的一股潮流，它将是我们的未来。

王凯
2012年7月
于上海

History of Infographic Design

信息可视化设计的历史

In prehistory, early humans created the first information graphics: cave paintings, later maps and now charts. Throughout the entire history of infographic design, images have been mixed with words from beginning to end. From the year 7500 B.C., map began to play its important role. Apart from the icons used in maps that marked the names of battles and places for reserving, words were introduced into maps, which turned the map into a new way of information expression that applied abstract graphics and words to describe the ancient living environment. As a great pioneering work from medieval scholars, the visualization of data had been used for showing the simple scientific basis and also analysing the deep rational thinking; these drawn data had been widely used in mathematics, astronomy, geography, social sciences, economics and other fields of scientific research, turning to be a commonly used data chart model today.

Information visualization has existed for thousands of years, but with the development of network in recent years as well as the global information explosion, it is gradually showing a new appearance. The original chart of statistical data is no longer just an ordinary chart medium; it gradually evolves into an integral part of the thinking and creativity in daily life, and closely connects to our learning and working.

在史前文明时期，人类便已经创造了第一种信息图形——洞穴壁画，而后，逐渐演变出地图和数据图表等其他信息图形种类。纵观信息可视化设计的整个发展史，图像和文字自始至终混合在一起，几乎到了难解难分的地步。从公元前7500年起，地图便开始了它的几千年盛世，除了用图标在地图上加注战役名及货物储备地之外，还加入了文字，使地图不仅成了带有记录含义的早期图表，也成了描述历代生活环境、生存状态等包含抽象图形和具象文字在内的综合信息表现形式。而将数据用形象化的方式绘制出来更是中世纪学者的伟大创举，它们既被用来表现浅显的科学道理，又用于分析深刻的理性思维；这些绘制后的数据被广泛应用于数学、天文学、地理学、社会科学、经济学等科学研究领域，更成为我们今天常用的数据图表模型。

信息可视化已有了几千年的历史，但随着近些年的网络发展和全球信息大爆炸，它逐渐呈现出一个全新的面貌。原先的统计数据图表不再仅仅是一个普通的图表媒介，它逐渐演变成日常生活中思维和创意不可或缺的一部分，与我们的工作学习紧密的连接在了一起。

Classification of Infographic Design

信息可视化设计的分类

Infographic design is a leading interdisciplinary technical art covering many fields. Naturally, designers engaged in this field always have very different educational backgrounds, traits of character as well as professional interests which contribute to various works with unique visual effects.

To detailedly illustrate the infographic design, here, according to different perspectives, we divide it into three categories:

1. Types of Infographics

1.1 Data Chart

There are many infographic designs suitable for the basic data which could be divided into five categories according to the types of data:

1.1.1 Total chart

Total chart is a visual interpretation of the overall statistical results, focusing on reflecting the proportional relationship of the data items. It can be divided into three kinds of charts:

■ Bar chart

Bar chart, just as its name implies, refers to using the length of the bar to stand for the comparison of data. (Figure 1)

■ Circle chart (pie chart)

Pie chart is a circular chart that is divided into sectors, illustrating the proportional relationship of data. (Figure 2)

■ Doughnut chart

Doughnut chart is always in a circular pattern to display the proportional relationship of data. The size of the slice is determined by the series value as a percentage of the total of all values. (Figure 3)

信息可视化设计是一个跨学科、跨门类、涉及面极广的前沿科技艺术，因此，从事信息可视化设计的设计师们自然也有着截然不同的教育背景、性格特征以及专业爱好，而这也导致了最终设计作品都以各自特有的视觉效果展现在我们面前。

为了更好的了解信息可视化设计，我们根据不同的视角，将其分为三个类别。

1. 信息设计的类型

1.1 数据信息设计

适用于基本数据的图表设计有很多种，我们按数据的类型种类把它们大致分为以下五大类：

1.1.1 总计表

总计表是反映整体数据统计结果的图表，在图表中反映总计数据中各个项目的比例关系。总计表可分为以下三种图表：

■ 柱状图

柱状图常以直条的图形显示各项数据间的比较状况。通过数条的长度来直观的显示各数据的比较关系（如图1）。

■ 圆形图（饼图）

圆形图常用圆形的方式显示各数据的比例关系，每一项数据以扇形的方式呈现，通过占整体圆面积的比例，直观的反映出数据间的大小关系（如图2）。

1.1.2 Grouped data

It refers to arranging raw data with a wide range of values into groups and presenting them in an infographic way. It can be divided into several types as the following:

■ Histogram

Like a bar chart, a histogram is made up of columns plotted on a graph, estimating the probability distribution of a continuous variable. However, it is quite different from the bar chart. Histograms are used to show distributions of variables while bar charts are used to compare variables. Y axis of a bar chart can represent anything and show the absolute value; while the Y axis of a histogram only presents the relative frequency of data. In histograms, each column represents the distribution and proportion of a variable. (Figure 4)

■ Line chart (also known as curve chart)

Line chart is a type of chart where a series of data points are connected together with a line. This chart type is used to show data trends, how parameters are related to each other or how one variable changes effected by another. (Figure 5)

■ 环形图

环形图常用环形方式显示数据的比例关系。不同的数据所占的环形圈的面积大小可直接反映出数据间的差异（如图3）。

1.1.2 分组数据

分组数据是指把不同的数据分组后，在一张可视化图表中显示出来，在同一组中的数据有相同的特性。分组数据图表又分为以下几种：

■ 直方图

直方图常用柱状的方式显示信息频率的变化状况，并从对比中显现不同项目的数据差异。

直方图与前面提到的柱状图有相似之处，但是，直方图与柱状图的信息内涵不同，柱状图的Y轴可以代表任何含义，展现的是绝对数值；而直方图的Y轴只表示数值出现的频率，最终虽然也用柱状的效果展现，但每个柱状体现的是数值频率数的分布和占据的比重或比例。（如图4）

■ 折线图（又名曲线图）

折线图常以折线的方式绘制数据图表，它能直观的显示出连续数据变化的幅度和量差。（如图5）

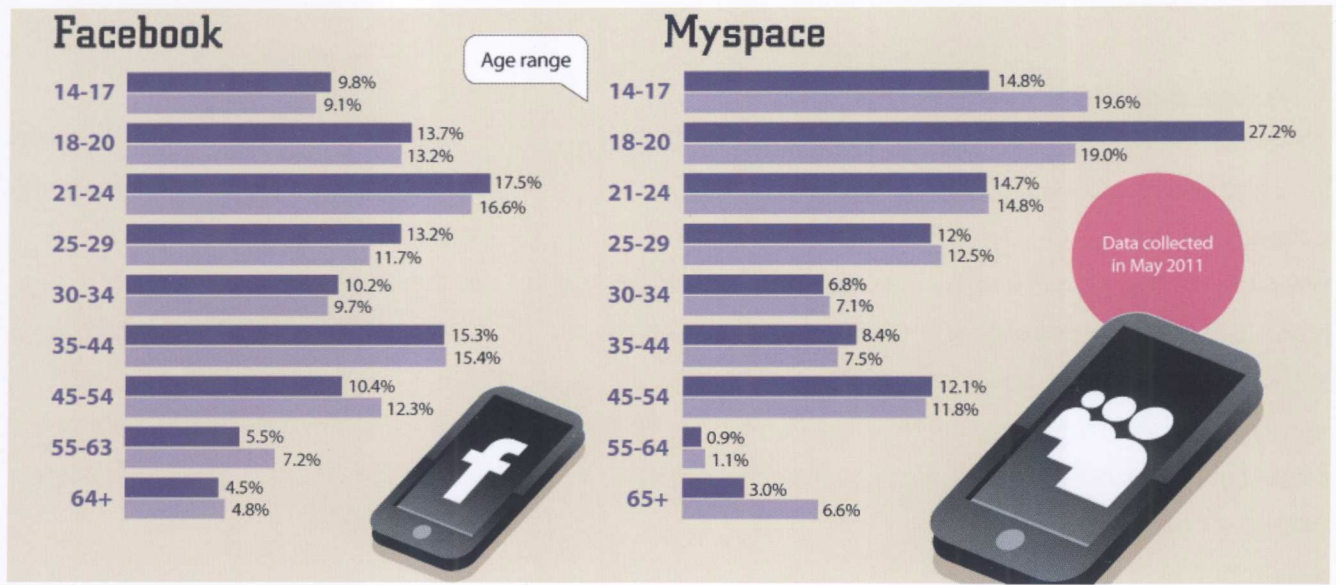


Figure 1 图1

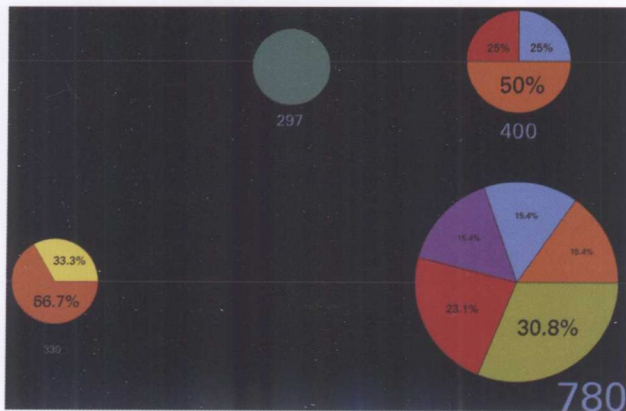


Figure 2 图2

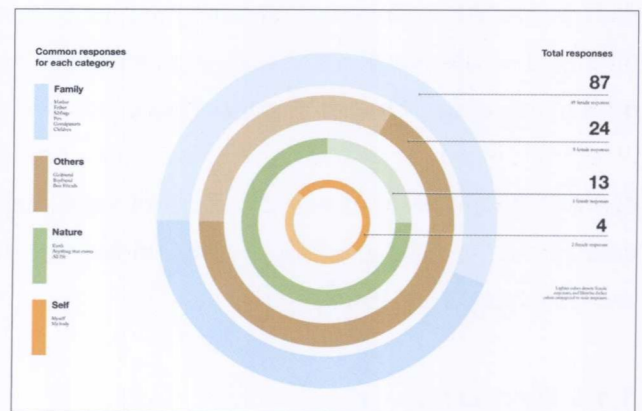


Figure 3 图3

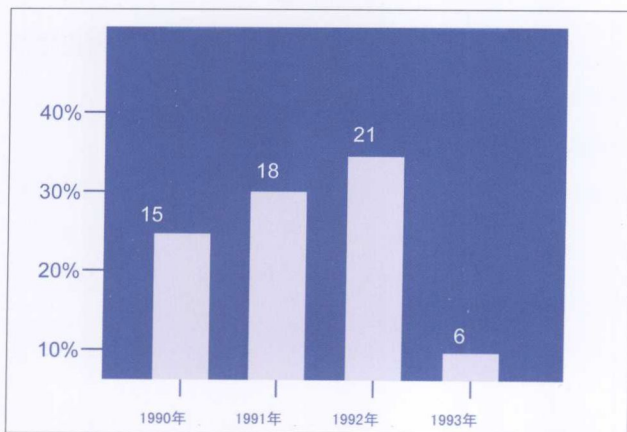
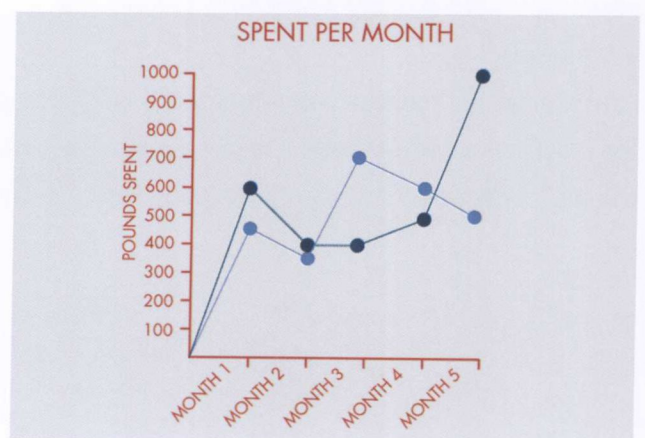
Figure 4: Statistical chart for 60 students in a class by year of birth
图4: 某班级60个学生出生年份统计表

Figure 5 图5

1.1.3 Raw data chart

The chart is composed of the data at different levels, which aims to clearly show the hierarchy data.

■ Stem-leaf plot

Stem-leaf plot, also called stem and leaf display, is a kind of graph that shows the numbers in the smallest place values as leaves, and those with larger place values as stems. It could provide a visual summary of your data, well illustrate the changes of the subsequent data and thus easily show the details of the project's characteristics. (Figure 6)

■ Box plot

Box plot, also known as a box-and-whisker diagram or plot, is an important tool for graphically depicting groups of numerical data through their six statistics: the largest observation, lower quartile, median, upper quartile, the smallest observation and outliers.

Box plot is commonly used in the chart of stock market but less used in the infographic design for its complex visual effects and data presentation. (Figure 7)

1.1.4 Time series data

Time series data refers to a way that displays the information visualization in the basement of time sequence.

■ Line graph

Line graphs are more popular than all other graphs combined in the statistics of regular variables since their visual characteristics clearly reveal data trends and maintain certain continuity. (Figure 8)

1.1.3 原始数据

原始数据图表是由不同层次结构里的数据组合而成的图表，通过这类图表的展示使得数据层次更加清晰。

■ 茎叶图

茎叶图又称枝叶图，它以变化较小的数据为茎，以变化较大的数据为叶，用树叶茎脉的方式直观的展示数据，并运用图形解释后续数据的变化状况，便于显示项目特性的细节。（如图6）

■ 箱线图

箱线图又称箱形图、盒须图或盒式图，是一种显示一组数据分布和分散程度的统计图。它利用数据中的六个统计量，最大值、第一四分位数、中位数、第三四分位数、最小值以及异常值从大到小的排列来描述数据。

箱线图在证券市场的图表中较为常见，但由于其视觉效果和数据展示上的复杂性，在信息可视化设计中，较为少见。（如图7）

1.1.4 时序数据

时序数据是指按时间发展规律为单位进行的信息可视化展示方法。

■ 线性图

线性图是按时序进行的轨迹反映数据特性的图表，这样的图表具有一定的连续性，多用在有固定变化规律的数据统计表中。（如图8）



Figure 6 图6

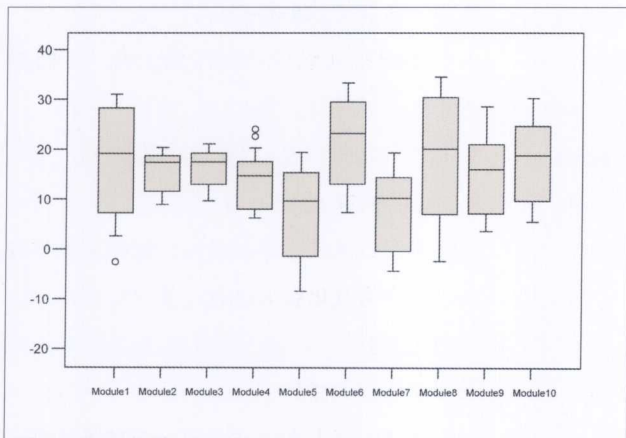


Figure 7 图7

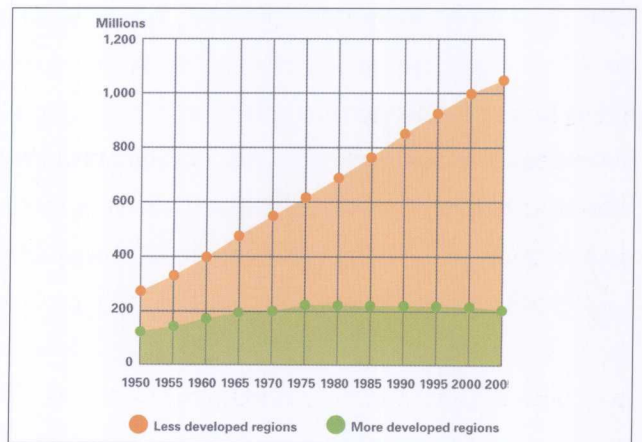


Figure 8 图8

1.1.5 Multivariate data

Multivariate data, just as its name suggests, is composed of different data types. These data types form an overall proportional relationship, which is clearly reflected in a chart.

■ Radar chart

Radar chart could present all different data in a graph with each of the sequence of equi-angular spokes representing one of the variables. It could easily illustrate the structural relationships between different data and the tendency. (Figure 9)

1.2 Illustration Chart

Illustration chart features a special sense of art which lets the viewer forget the data and be completely immersed in the scene or interesting graphic symbols, for which reason it has been widely used in the infographic design by art enthusiasts. (Figure 10, 11)

1.3 Map Chart

Map chart is a totally different type, which is composed of a dozen of “mini” illustrations that can be graphics, lines or colour lumps; these combined illustrations with their special shapes and colours go harmoniously with the data and thus create special aesthetic effects on the balance of visual effects, effectively delivering the information to the target audience. (Figure 12, 13)

1.1.5 多元数据

多元数据，顾名思义就是由不同的数据类型组成的一张图表。这些数据项目组成了一个整体的比例关系，并在同一张图表上得以体现。

■ 雷达图

雷达图往往将不同的数据反映在同一个图表上，并且用雷达发射状的方式显示不同的项目，它能方便的体现出不同数据间的结构关系以及发展趋向。（如图9）

1.2 插图信息设计

插图图表有种特殊的艺术魅力，能让观者暂时忘却复杂冗长的数据信息，完全沉浸在场景或者有趣的图形符号中，因此，被艺术设计爱好者广泛的用于信息可视化设计中。（如图10、图11）

1.3 地图信息设计

地图信息设计是可视化设计中一个特殊的类别（如图12、图13），它由“一打”、“迷你”插图组成，它们可以是图形，也可以是线条或者色块；当这些插图结合在一起的时候，却又能因其造型、色彩和信息搭配，而在视觉效果和画面平衡上获得特殊的审美效果，并有效的将信息传递给受众群体。