



Can you see the wood for the trees?
A guide to making clear simple graphics

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Preface

Producing reports for Parliament on the value for money of public services presents a significant challenge. To be successful, our reports must be easily understood and designed to make an impact. There is no scope, within the brief window of a Public Accounts Committee hearing, for Members of Parliament to spend time analysing and interpreting the findings contained in daunting pages of dense text. The reports must spell out concise messages which are clear and unequivocal.

Typically for VFM work, this involves distilling large amounts of technical information and jargon into a short and structured narrative which someone with no expert knowledge of the subject can readily understand – a challenging process, made more complicated by the requirement to agree in detail the factual accuracy and balance of our reports with the audited body. But words are not the only – or even the best – means of conveying a compelling message in a short space of time. The use of tables, charts and images is essential if we are to communicate our evidence, findings and conclusions in a clear and attractive way that increases understanding and allows the reader to absorb lots of information in a short space of time. For busy people, such as MPs and Accounting Officers, effective graphics and the judicious use of design are a necessity in order to get the message across quickly, convincingly and in a way that is memorable.

This guide has been produced to help auditors to present information effectively so that it conveys a strong message and meets the needs of our clients. The overall theme of the guide is perhaps best captured by the expression "less is more". By reducing and simplifying the data and the way it is presented, we can add clarity, increase our impact, and save the reader time in interpreting, or perhaps misinterpreting, a mass of detailed information.

The golden rule for designing graphics for a report is to always ask yourself one simple question: ***"Is the message that this graphic conveys immediately apparent to a cold reader?"***

If it is not, then look again at the title, the choice of graph or chart, and whether the data presented can be reduced and simplified or the salient feature highlighted. If re-design, reduction or simplification does not solve the problem, then consider whether the graphic serves any useful purpose in the report at all. It may provide what is inherently "interesting" information, but this is not enough if it does not serve to support the overall findings and messages that are the conclusion of the study. Information that may be interesting to researchers in the field, but does not contribute to the central theme of the study, can be presented more effectively outside the covers of the published report, such as on the internet or in an academic article.

We hope this guidance proves valuable in helping you to design effective graphics for reports, and that it prompts you to think of using graphics where you would previously have resorted to narrative. But if the design of a particular graphic or series of graphics throws up problems that are hard to resolve, then don't grapple with them alone. Advice and technical support is always at hand from the VFM Development Team, the Design Group, or the guide principal authors, Sally Bigwood and Melissa Spore of Plain Figures.

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Part 1: The principles of good graphics

This chapter sets out the principles of effective graphical presentation and the things we need to consider when designing graphics to convey information in NAO reports.



Interest in how to best present numeric data and other graphics has increased in the last few decades. There is growing evidence about practices that work: the formats, arrangements, and details that communicate information most clearly. These guidelines have been written with this new understanding in mind and to give, as far as possible, reasons for choices about visual information.

- 1.1 This guide is designed for NAO staff in order to
- Improve the quality of graphics to convey information in NAO reports;
 - Enhance understanding of the kind of presentations that work and why; and
 - Introduce a consistent standard for presenting graphics in NAO reports.

This guide replaces the 1998 publication, *Presenting Graphics in reports: A guide*. It contains examples of good practice and ideas on how one can communicate information and ideas through graphics to improve the quality of our drafts.

What are information graphics?

1.2 Information graphics - or information visuals, data graphics, conceptual graphics, and information design - all refer to the visual display of information.

- Road maps are information graphics for finding your way;
- Line charts are information graphics for comparing numeric data;
- Flow charts are information graphics for seeing stages in a process;
- Text boxes are information graphics for quick reference to categories and subcategories.

1.3 The common denominator is that graphic arts are used for conveying information. They are not decorative, nor, in the refined sense, artistic. Creating them requires sound judgement rooted in both subject knowledge and graphic principles. The emphasis and the measure of success is how well the audience understands the information.

Who's the audience?

1.4 The target audience for the NAO's reports is Parliament and the Public Accounts Committee, senior officials in departments and agencies, and other public sector professionals. Other readers include government ministers, journalists, interest and pressure groups, members of the public, business managers (for instance, in contracting or regulated industries), and university academics.

NAO reports – as all publications – should be written for the audience. The text and illustrations should address the question "What do readers need to know?".

1.5 Most of our target audience are busy readers and will not study reports or read from beginning to end. They are likely to skim the publication to get a general idea, and then select portions they wish to read. When readers skim they focus overwhelmingly on:

- Organisers: the contents page, headings, and sub-headings;
- Summaries: the Executive Summary, concluding paragraphs and highlighted findings, conclusions and recommendations; and
- Distinctive figures: especially tables, charts, diagrams, maps, text boxes and photographs.

We need to ensure that these are used to full effect to draw the reader to the most important messages we want them to receive.

Why is good presentation of information important?

1.6 Good presentation is essential. The NAO's standing, at least in part, relies on the quality and reputation of VFM reports. They are a major route through which the audience comes into contact with the work of the NAO. They need to appear both comprehensive in their thorough examination of issues and concise in their analysis and explanations. The use of data and information graphics should support these objectives. Good presentation is vivid, easily understood, and meaningful. Individual graphics and publications should display these qualities.

What can we do to improve the presentation of visuals in VFM reports?

1.7 The principles and advice laid down in these guidelines are adapted from the books listed at the end of the guide, in particular, Bigwood & Spore and Chapman.

Here is a summary of the six key principles of graphic design:

- Design the graphic for the reader. Consider what data and information will help them understand the evidence or arguments.
- Know your purpose. Before designing a table, graph or chart, be aware of the explicit point you are trying to show. This awareness will lead to displays that are specific and meaningful.
- Organise the display or illustration so that your point is obvious. Avoid smothering your point with too much data or camouflaging it with unhelpful decoration.
- Make titles and labels clear and concise. All data graphics and other illustrations should be self-explanatory, so that readers should not have to refer to the main text to understand them.
- Ensure that financial analysis of the area under scrutiny is clearly presented.
- Use graphics strategically to give prominence to important themes. Where appropriate, focus in particular on issues of relevance to members of the Public Accounts Committee.

The two stages in developing graphics

1.8 It is helpful to be aware of the two stages involved in developing good information graphics. During the **Discovery Stage** you are experimenting with the data, trying to work out what it means and how it may be helpful to explain the issues. During this stage you can hold the data or use it in anyway convenient to yourself. The **Presentation Stage** comes when you wish to present the graphic to others. At this stage your priority must be to communicate a message or idea to the readers. The goal is to create coherent and accessible visual information. User-friendly graphics must be the outcome of the final stage.

Presenting clear data on resource use and social inclusion

1.9 VFM reports provide independent evidence to Parliament on how departments make best use of taxpayers' money and public assets. The Committee of Public Accounts expects an analysis of trends in costs and financial performance to feature strongly in the reports. We should normally seek to convey this information clearly and concisely by using an appropriate table or chart in the Executive Summary (see [Example 1 opposite](#)).

1.10 Correspondingly, other numeric information that is important to understanding our conclusions and recommendations should be emphasized by presenting it graphically. For example, Parliament and the Public Accounts Committee have a particular interest in knowing whether parts of the population are disadvantaged by the way services are delivered, so presenting data on social inclusion is often significant and helpful to our readers.

1.11 This might involve demonstrating the impact of a policy issue or a particular service on different sub-groups of the population. Relevant data might be available from a number of sources beyond the department's own records, including the 2001 Census, data from the Office of National Statistics and the Department of Work and Pensions, and standardized mortality rates and other health indicators published in the Health Survey for England (see [Figure 1 opposite](#)).

Reducing the data increases its impact

1.12 The practical use of numbers and statistics demands decision-making: choosing what to show and how to show it. A decision of what data to exclude and what to merge and simplify is crucial to presenting figures that inform the audience. The primary decisions involve determining the message and reducing the data to the minimum needed to explain the message.

1.13 Only display the numbers that help you make your point. Although you may find all the data interesting, succinct tables which demonstrate a point are more persuasive than reference tables, and graphs with a single, clear message are more persuasive than those that display too much data (see [Example 2 overleaf](#)).

Seven steps for reducing data

Step Explanation

- 1 Be familiar with (and understand) your data.
- 2 Consider your audience's background, knowledge and interests.
- 3 Based on the data and the audience, determine what the numbers say and your message.
- 4 Select numbers that support the message.
- 5 Determine the appropriate visual display (table, bar chart, line graph, etc.).
- 6 Prepare each table or graph for the medium (paper, webpage, PowerPoint) in which it will appear.
- 7 Test the display on a sample audience.

Using these guidelines

1.14 The remainder of the guide describes the types of figures commonly used in VFM reports and best practice guidelines for each figure type. [Section 2](#) discusses the best ways of presenting numbers and tables. [Sections 3 and 4](#) show how to choose the most suitable charts for getting your message across and the different charts which are commonly used. [Section 5](#) describes best practice for using non-numeric graphics such as flowcharts, text boxes and photographs.

Further information on any aspects of this guide is available from the Design Group, the VFM Development Team or the guide principle authors, Sally Bigwood and Melissa Spore of Plain Figures (<http://www.plainfigures.com>).

Example 1: Presenting clear data

Example of financial analysis in a VFM report, taken from the Executive Summary of HC975: Managing the National Lottery distribution fund balances.

X Distributors' National Lottery Distribution Fund balances at 31 March 2004

Distributor	Balance (£ million)	Percentage of balance
Heritage Lottery Fund	942.6	34.4
New Opportunities Fund	737.2	26.9
Arts Council England	224.1	8.2
Community Fund	213.3	7.8
Sport England	201.6	7.4
Millennium Commission	155.7	5.7
Sport Scotland	65.0	2.4
UK Film Council	44.3	1.6
Scottish Arts Council	42.0	1.5
Arts Council of Northern Ireland	35.6	1.3
Arts Council of Wales	24.0	0.9
Sports Council for Northern Ireland	23.5	0.9
Sports Council for Wales	21.5	0.8
UK Sport	3.8	0.1
Scottish Screen	2.2	0.1
Total ¹	2,736.3	100.0

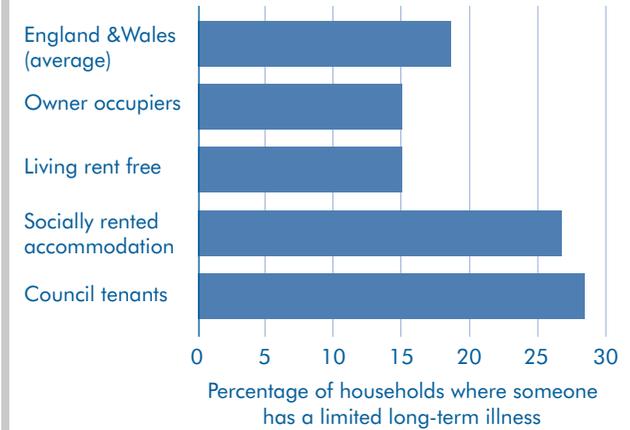
Source: Data from the department for Culture, Media and Sport

NOTE 1: This figure does not cast correctly due to rounding.



1 Social housing and ill-health

People living in social housing in England and Wales are more likely to suffer from a limited long-term illness than others.



Source: Table SO17 2001 Census



Example 2: Reducing data to increase impact

Look at this short reference table:

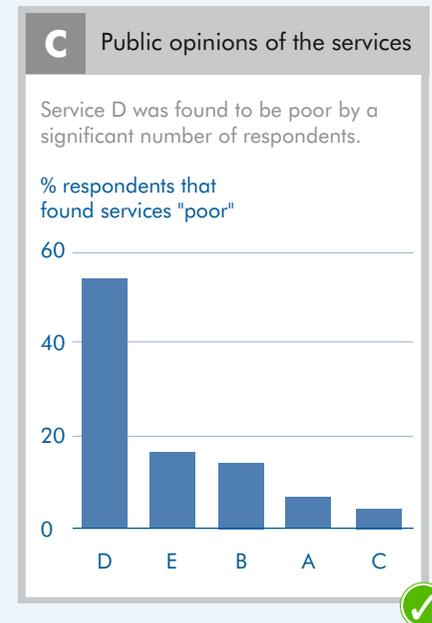
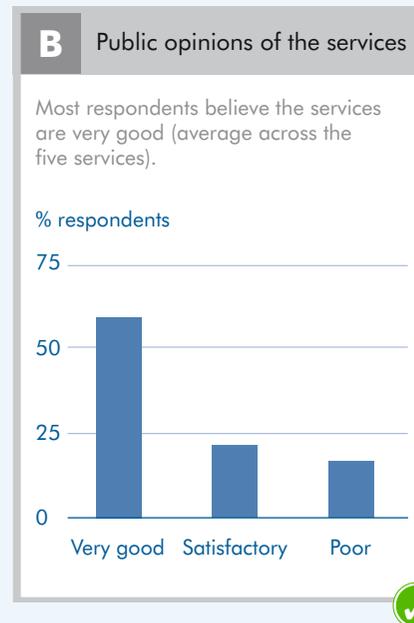
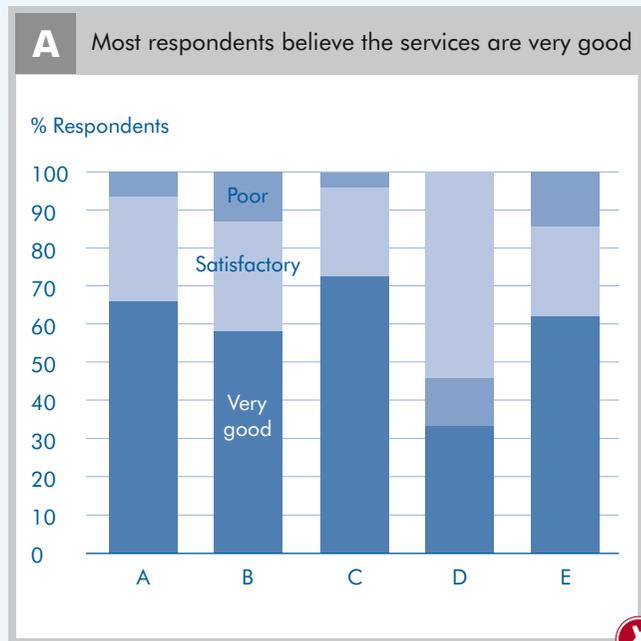
Public opinions of the services			
Analysis of 1,200 respondents			
Percentages May 2004			
Services	Very good	Satisfactory	Poor
A	66	27	7
B	58	29	13
C	72	24	4
D	33	13	54
E	62	24	14
Average	58	23	18

A number of stories can be told from this data and a number of graphs could be created. Showing all the data – either by reproducing the table in full or by putting it all into a graph - does not direct the reader to any message (**Figure A**).

While readers may eventually work out some message in this graph, you haven't made their job easy. Information should be set out for the convenience of the reader.

By deciding on the message and reducing the data accordingly (**Figure B**), you can focus their attention and get your message across quickly.

Of course you might wish to tell another story with the data, as **Figure C** shows. What is important is deciding on the explicit message and limiting the data to support that point.



Part 2: How to present numbers and tables

This chapter discusses best practice on presenting numbers, designing tables and writing about numbers in text.



NAO reports rely on figures and other visuals to convey messages to the reader. They should be presented in a succinct and unequivocal manner to make them easy to understand. As with all information, focus on your purpose and your audience. Provide the reader with an order and structure that reinforces the message.

How to present numbers

2.1 Guidelines have evolved for presenting numbers so readers can interpret them accurately and quickly. Consider the following when arranging numbers:

- List numbers in an order.
- Place items to be compared in columns, not rows.
- Add focus through averages, totals or percentages.
- Use layout to guide the eyes.
- Round figures for clarity.

Order and organise numbers

2.2 Organisation is the responsibility of the writer and developer, not the audience. The organisation you give the data includes order of numbers. Size order – largest to smallest – is the preferred arrangement for most numeric displays (see Example 3).

Keep Comparisons Close

2.3 Comparisons need to be physically close: this is the principle of proximity. Numbers in columns are physically closer than numbers in rows. Additionally, we are accustomed to adding and subtracting in columns.

Add focus

2.4 Averages, totals or percentages help the reader make sense of the data and add focus. Averages are particularly useful to show patterns and exceptions. Totals provide helpful information when the overall figure is of interest, such as budgets or number of staff in a department. Percentages allow figures with different denominators to be compared on the same scale, such as customer satisfaction.

Round figures

2.5 Rounding simplifies numbers, making them easier to read, use and recall later. NAO reports need to set out figures for the convenience of lay readers. Rounding helps this (See Example 4).

Consider:

- Official statistics are often more detailed than is credible. For instance, precisely 23,847 telephone calls is unlikely.
- Exact figures may seem to be spurious, unconvincing or misconceived. An opinion poll or survey with a sampling error of plus or minus three percent makes the result of 57.8% absurd.
- Most people cannot mentally calculate the difference between 69.66 and 34.73. But they can easily see that 70 is twice 35.

Example 3: Put numbers in size order

Listing numbers in size order makes tables easier to read and use. It helps readers make sense of the data quickly.

X Put numbers in size order		X Put numbers in size order	
Alphabetical order		Number order	
Birmingham	170	Manchester	270
Leeds	230	Liverpool	250
Liverpool	250	Newcastle	250
Manchester	270	Leeds	230
Newcastle	250	Sheffield	210
Sheffield	210	Birmingham	170
Source: ABC reference 2004		Source: ABC reference 2004	

Example 4: Round Figures

Variable rounding is simple and statistically accurate. It allows you to round all numbers in a set to two digits regardless of the size of the number.

X Variable rounding		
Original number to thousands	fixed rounding to two digits	variable rounding
12,345	12,000	12,000
1,234	1,000	1,200
123	0	120
12	0	12
1.2	0.0	1.2

How to design tables

2.6 Tables organise and condense information, facilitating calculations, promoting comparisons and easing the location of data. Tables also clarify or reinforce written text.

Use tables to show

- the numbers
- large amounts of data (reference material)
- few numbers (not enough for a chart)
- a large range between the largest and smallest numbers.

2.7 There are two types of tables:

- **Reference tables** provide precise and comprehensive information, such as those found in school league tables and hospital waiting lists. These tables usually appear in the appendix of a report.
- **Demonstration tables** provide selected data that emphasise a particular message or idea. They should be short and to the point. The data needs to be arranged to suit the message. Demonstration tables appear in the main section of the report.

This guide focuses on demonstration tables. Reference tables rarely appear in VFM reports.

Guidelines for tables:

2.8 Tables must emphasise and clarify the numbers. To do this:

- Insert blank space rather than gridlines to define borders. Avoid vertical lines; they block the eye as it scans a row. If you must use gridlines, keep them faint.
- Align numbers and column headings to the right for accurate reading.
- Use single spacing. Auto-formats and other software functions are set at 1-1/2 spacing. Items to be compared should be close together.
- Keep tables narrow. Items should be close together vertically and horizontally, not artificially stretched across a page. Again, avoid automatic formats that stretch tables out.
- Write comprehensive titles and succinct headings. Avoid obscure abbreviations.
- Limit bolding and shading; emphasise the data not the decoration (see Example 5).

Example 5: A model table

In this table, the eye is guided by blank space rather than gridlines or shading.

X Table title				
Use the sub-title to explain the purpose of a demonstration table. It will ensure readers understand message.				
	Multi-column heading		Multi-column heading	
	heading	heading	heading	heading*
Row head	xxx	xxx	xxx	xxx
Row head	xxx	xxx	xxx	xxx
Row head	xxx	xxx	xxx	xxx
Row head	xxx	xxx	xxx	xxx
Row head	xxx	xxx	xxx	xxx
Row head	xxx	xxx	xxx	xxx
Row head	xxx	xxx	xxx	xxx
Row head	xxx	xxx	xxx	xxx

Source: ABC Reference, 2004

* Footnotes should be rare and indicated with an *, +, etc., in preference to a number (which may be confused with the numbers in the table).

Specific points to note:

- table font is slightly smaller than the surrounding text
- the table is narrower than the margins on each side
- blank columns and rows are inserted to help guide readers through the data and give the table a relaxed yet ordered look.

Titles and sub-titles

2.9 Titles and sub-titles of tables in NAO reports should be self-explanatory. Most readers look at tables, pictures, and graphs before reading.

2.10 Generally, the title gives the global subject, place, date, and units. The subtitle can be discursive: one or two sentences suggesting the meaning and salient points. In demonstration tables, a sub-title can direct readers to the patterns and exceptions in the data.

2.11 One good use of table sub-titles is the NAO publication *The Ministry of Defence: The Construction of Nuclear Submarine Facilities at Devonport (HC 90: 2002-03)*, as shown in **Example 6**. Note how each subtitle provides context and directs the reader.

Checklist for table titles

Does the table title include information on

- 1 **What:** people, events, actions, items etc?
- 2 **Where:** England and Wales, UK, Greater Manchester etc?
- 3 **When:** 1990-2004, May-July 2003 etc?
- 4 **Units:** money, percentages, kilos, miles etc?

Columns and row headings

2.12 Headings must quickly orient the reader; they should be succinct and relevant.

To improve headings, move information into the title and subtitle. A table with four hospital trusts and three primary care trusts can be organised so that the title accommodates both types of trusts. Individual entries need not repeat information (*St. Mary's Hospital and North Leeds PCT* rather than *St. Mary's & University NHS Hospital Trust and North Leeds Teaching Primary Care Trust*).

Avoid obscure abbreviations that have not been defined in the text.

Show patterns and exceptions

2.13 If the reason for the table is to show a trend, make the trend prominent. Patterns and exceptions in the data should be obvious, at least after they have been explained in the title and text. **Figure 2 opposite** shows how the sub-title can emphasise exceptions in the data.

Example 6: Title and sub-titles

X The Department's budget for the project

The Department had to increase its original budget for the project.



X Cost increases on the DML contract

The Department has identified broad cost estimates for the reasons for the increase in DML's costs on the contract.



X Revised payment mechanism

Under the revised contract, costs in excess of £684 million are shared between the Department and DML.



2 The North scores higher overall

The North outperformed the South in every aspect, excepting B, where the South surpassed the North.

	Thousands	
	North	South
A	18	15
B	14	20
C	12	9
D	8	6
Average	13	10

Source: Data from the department for Culture, Media and Sport



Bold and shading within tables

2.14 Allow white space and good design to accentuate your data. Bold and shading is like garlic: a little goes a long way. Overuse will distract. This is illustrated in [Example 7](#).

Discuss tables in text

2.15 All figures should be referred to in the text with at least a short summary or explanation. "Table 7 shows expenditure has doubled in the past eight years" is more helpful than saying "See Table 7 for changes" (which neither summarises nor explains).

Totals and sub-totals

2.16 Insert totals at the bottom (never the top) of a column of figures. It is conventional and allows readers to add up numbers conveniently. Drawing out sub-totals can make the data easier to understand quickly. It can also reduce the size of tables, as in [Example 8 overleaf](#).

Larger tables

2.17 Try to avoid long tables in NAO reports. They require more concentrated study than readers are likely to give. Their appearance can be off putting to the audience. Consider if all the data needs to be shown. Can it be split into two or three shorter, more succinct tables? Should it be in the Appendix? If you must use a large table, say over seven rows, insert a blank row every four or five lines. This guides the eye without adding the clutter of gridlines.

“ The presentation stands and falls on quality, relevance and integrity of the contents ”

Edward R. Tufte, statistician

Example 7: Use bold and shading judiciously

In the table on the left, seven of the 15 numbers are emboldened. The patterns within the data itself (row 2) are less arresting to the eye than the bold. The table on the right makes better use of bold to emphasise the patterns.

X Table title			
Comment text goes here.			
	heading	heading	Total
Row head	xxx	xxx	xxx
Row head	ccc	ccc	ccc
Row head	xxx	xxx	xxx
Row head	xxx	xxx	xxx
Total	xxx	xxx	xxx

Source: ABC Reference, 2004

X Table title			
Comment text goes here.			
	heading	heading	Total
Row head	xxx	xxx	xxx
Row head	ccc	ccc	ccc
Row head	xxx	xxx	xxx
Row head	xxx	xxx	xxx
Total	xxx	xxx	xxx

Source: ABC Reference, 2004

Light shading can also be used to draw attention to selected figures. Note, however, that shading can overwhelm a small table.

X Table title			
Comment text goes here.			
	heading	heading	Total
Row head	xxx	xxx	xxx
Row head	ccc	ccc	ccc
Row head	xxx	xxx	xxx
Row head	xxx	xxx	xxx
Total	xxx	xxx	xxx

Source: ABC Reference, 2004

How to write about numbers

2.18 In our reports, we often write about numbers as well as show them in tables and graphs. For readable figures:

- Limit the use of numbers in your sentences and paragraphs. More than five or six numbers in a paragraph becomes confusing. Consider inserting a list or a short table instead.
- Whenever possible express figures in ways that will remain meaningful over time. Use percentages, ratios and indexing.
- Express figures in helpful ways. For instance, "17 in every 10,000 children" is more readily understood than "0.0017 children".

Writers' conventions

2.19 Writers' conventions developed over hundreds of years can help express numeric ideas clearly. Here are a few:

- Spell out words one to ten. The exceptions are decimals and fractions, for instance 8.5 or 8-1/2.
- If a series includes numbers above and below ten, use digits. For instance 1, 7, 14 and 28 rather than one, seven, 14 and 28.
- Keep consistency between tables and text. If a number is listed in a table as "70," the text reference should be the same, not "seventy".

Example 8: Use sub-totals to clarify

X Sub totals lost in the data	
Heading A	
Sub-head a	20
Sub-head a	20
Sub-head a	20
total	60
Heading B	
Sub-head b	20
Sub-head b	20
Sub-head b	20
total	60
Heading C	
Sub-head c	20
Sub-head c	20
total	40
Grand total	160



X Sub totals showcasing the data			
Heading A	Sub-head a	20	60
	Sub-head a	20	
	Sub-head a	<u>20</u>	
Heading B	Sub-head b	20	60
	Sub-head b	20	
	Sub-head b	<u>20</u>	
Heading C	Sub-head c	20	40
	Sub-head c	<u>20</u>	
Total			160



Organising figures in text

2.20 How figures are organised in a sentence can aid readers' comprehension. Most readers can follow only three or four figures in a sentence and six figures in a paragraph. It is better to have two or three short, lucid sentences than a single baffling sentence (see Example 9).

Large numbers

2.21 Larger, longer numbers need special consideration when communicating to a lay audience. For instance:

- Long tails confuse, so shorten £5.325million to either £5.3m or £5.3million.
- Write £5m-£10m (rather than £5-10m).
- £7.8m is preferable to £7,800,000.

Checklist for tables and numbers

Can you answer 'yes' to the following?

- Is the title unambiguous and substantive?
- Do the title and sub-title direct readers to the message and salient points of the table?
- Are column headings and row labels succinct and coherent?
- Are numbers arranged in an order (preferably, from largest to smallest)?
- Are the numbers rounded (or is there a good reason not to round)?
- Are items to be compared close together?
- Is the table discussed in the text?
- Is the source listed?
- Are bold font and shading used with care and restraint?
- Are grid lines deleted or minimised?

Example 9: Avoid too many figures in text

Look at this paragraph.

The average UK house price rose from £119,938 in the first quarter of 2003 to £140,225 a year later, a rise of 16.93%. There was much regional variation within this; houses in London averaged £225,379 in the early months of 2004, up from £191,090 a year earlier and in the North, average prices increased from £81,226 by £27,029 to £108,225 during the same period.

Source: Nationwide Housing Price Index, 2004.

The revised version, below, is shorter and easier to absorb. By reducing the number of figures, rounding drastically, substituting percentages and shortening sentences, the ideas become lucid.

Average UK house prices increased by 17% from £120,000 to £140,000 in the year ending March 2004. There was much regional variation within this. The average cost of houses in London rose by an average of 13% to £230,000; in the North, prices increased by over 33% to £110,000 during the period.

Part 3: Designing effective graphs

This chapter will look at principles, purpose, titles and text and design tips applicable to all graphs.



Graphs or charts excel at showing broad trends and relationships. The best graphs are vivid, memorable and meaningful. They are popular with readers and make National Audit Office reports more interesting and relevant.

Why use graphs?

3.1 Successful graphs communicate immediately. The best graphs will

- focus on trends and relationships
- be readily accessible
- improve the data being related in a table or in text.

Graphs compare data. They can be used to display a range of comparisons, including:

- changes over time
- parts of a whole
- correlations
- trends and relationships
- frequency distributions.

Principles

- Think of your audience when designing a graph. How can you give them the information in a vivid and meaningful way?
- Graphics in reports should be self-explanatory. Readers should not have to refer to the report to understand a graph.
- Start your scale at "0" or explain why. Readers assume numbers begin at zero and need to have exceptions pointed out.
- Avoid distortions such as three-dimensional graphics and unusual formats. Readers rely on familiarity when interpreting information from graphs.

What is the purpose?

3.2 Presentation graphs are powerful when they have an explicit message rather than a vague one. The numbers and design should serve the purpose. If you are unsure what the numbers mean—if no trend or exception emerges—rethink using a graph. Even when displays seem clear, they may lack a message for the audience. Think of graphs like fine liqueurs: they need to be distilled to ensure that the flavour (the essence, the point) is distinct and strong. There may be several trends in a set of numbers; choose the one that has meaning for your subject and audience. Remember that you can always present a series of graphs if the data contains several interesting patterns.

How to design graphs for communication

Keep focus on the data

3.3 Graphs need to be kept simple, with all the focus on the information. Edward Tufte coined the phrase "data ink ratio," the principle that ink spent on data must far outweigh ink used for display or decorative purposes (see Example 10).

3.4 Four elements interfere with successful graphs:

- Gridlines prevent the eye from taking in the data elements (the bars, columns and lines that matter).
- Data labels (numbers on the graph) are irrelevant and distracting. People concentrate on the visual message in a graph. Also, graphs excel at representing broad trends and relationships. If readers need to know the numbers, give them a good table rather than a cluttered graph.
- Clutter, such as multiple font faces, borders, bolds and underlines, distract from the graph message.
- Colour and shading should help readers, not hinder them.

How to write titles and text

Use titles to explain the purpose

3.5 Use the graph's title to explain and re-enforce the purpose of the graph. Consider these titles:

Maintenance expenditure has declined since 1999-00 high

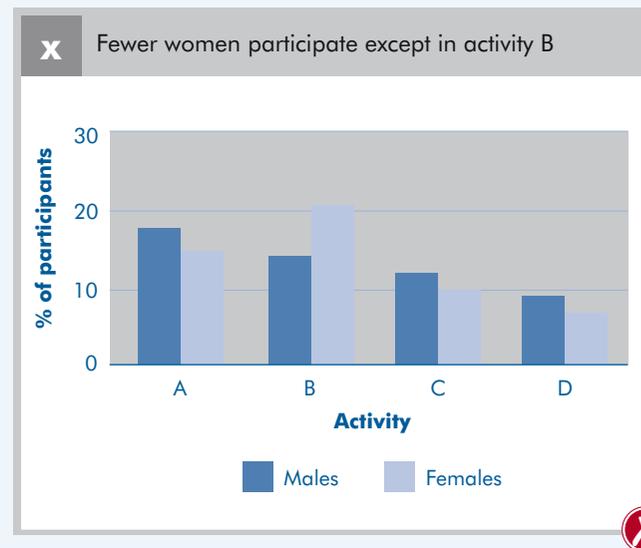
Expenditure on maintenance 1998-99 to 2002-03

The first is decisive and summarises the purpose of the graph. It tells readers what to look at. Titles can be entire sentences or summaries resembling headlines. They need to include verbs to give the purpose and direction to the readers.

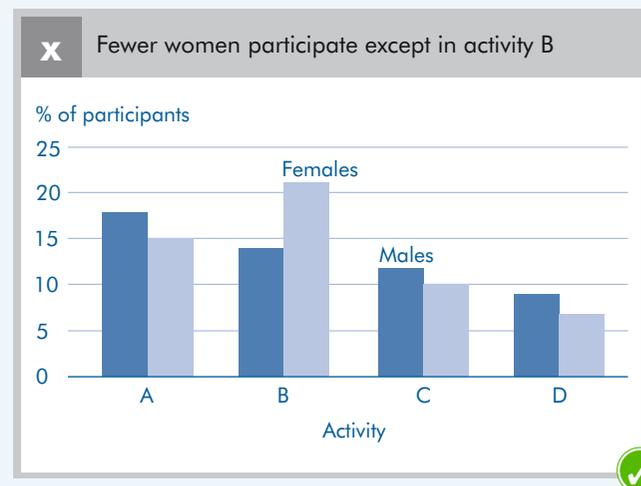
Titles focus your message. If you can't think of a good title, you may need to re-examine your purpose. Also, show it to colleagues; conversation often clarifies purpose and title.

Example 10: Poor design hinders understanding

Careless design damages this graph's ability to communicate: the shaded background, gridlines, key legend (and failure to label bars individually), borders and vertical labels interfere with the meaning. The overall appearance is amateurish.



The design below relies on the data not the decoration.



Put complete information in titles

3.6 Readers need a complete explanation of what the graph is about. Use sub-titles to supply further information. They must describe the data accurately and give supporting information. The title can first state the message, then follow with necessary details. **Figure 3 opposite** shows how the title and subtitle can be used to explain and re-enforce the purpose of a graph. Locating the subtitle between the title and the graph encourages people to read it.

Example 11 shows more ways to make titles informative.

Use explicit labels

3.7 Explicit labels help readers understand the illustration. There are several considerations which add clarity to your graphs:

- Directly label bars, lines and pie slices. Moving from legend to graph absorbs a surprising amount of mental capacity that could be applied to understanding. Individual labels are more convenient for readers.
- Text should be large enough to read and, ideally, horizontal.
- Avoid abbreviations unless they are well known.

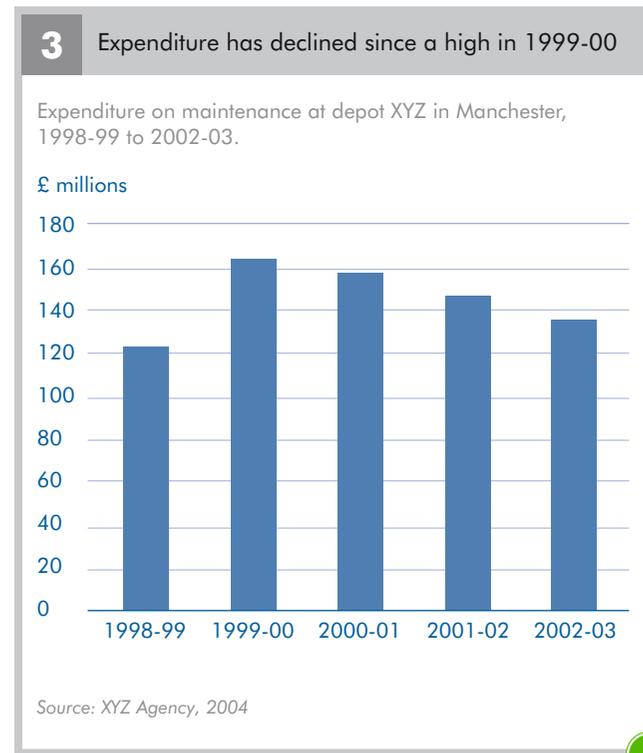
Footnotes and qualifiers

3.8 Footnotes on graphs are awkward. Keep them short; where possible, transfer the information to the sub-title or the text itself.

How to place graphs on the page

3.9 Place graphs near relevant text. Ideally graphs should be at the top or bottom of the page, never surrounded by text.

“ Above all else,
show the data ”
Edward R. Tufte, statistician



Example 11: Make titles informative

Avoid this:

The average yearly price for gold over the last twenty years

Outstanding clinical negligence compensation claims

Financial savings 1993-2004

Savings come from a number of areas

Prefer this:

The price of gold has been falling fairly steadily for twenty years

The number of outstanding clinical negligence claims nearly doubled between 1995 and 2001

There has been an upward trend in savings

The majority of savings arise from VFM work

How to use colour and shade effectively

3.10 The VFM standard for shaded rather than coloured graphs agrees with best practice. In addition to problems with colour-blindness, an increasing number of users will be downloading NAO reports from the website via black and white printers. They will also miss any point reliant on colour.

3.11 To use colour sensibly, make shaded differences apparent. Subtle (less than 20%) distinctions in shading may not be apparent on the web or printed out. Alternate shades are necessary for more than multiple components.

3.12 Avoid shaded backgrounds. A white background emphasises the data (see Example 12).

Collaborating on draft reports

3.13 NAO reports depend on members of the team. Developing good graphs depend on communication between the subject matter experts, the authors, and the graphic designers. There are many steps between an idea and the final graph. Only collaboration can ensure the data and message suit one another and that the design represents both.

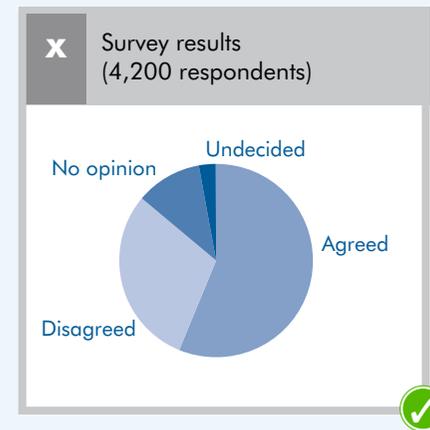
Checklist for graph design

Can you answer "yes" to the following questions?

- Are data labels easy to read and horizontal?
- Is the title a phrase or sentence indicating the explicit purpose of the graph?
- Does the sub-title efficiently give readers comprehensive information?
- Is every bar, slice or line individually labelled?
- Do bars and slices vary by shade rather than by colour?
- Are gridlines deleted or as faint as possible?
- Is the background clear with no shading?
- Are borders eliminated or faint?
- Are data labels eliminated?

Example 12: Use colour effectively

The graph below contrasts shades, allowing readers to make distinctions easily. The lack of background colour and design puts the emphasis on the data rather than extraneous matters.



Part 4: Choosing the right graph

This chapter discusses specific types of graphs, for example bar, line, pie charts, and histograms.



Choosing the right graph is the key factor in conveying messages in value for money reports. If the graph is not fit for purpose, messages will be lost and the readers will lose interest. Using High Impact graphics, and simplifying more detailed graphs will deliver messages much more effectively than more complex figures.

4.1 NAO reports should generally rely on high impact graphs, that is, basic:

- vertical or horizontal bar charts
- line graphs
- pie charts.

These are explained in detail below.

Histograms, and scattergrams can be useful but should be used sparingly. Other types of graphs are more complex. Variations on the high impact graph-types, such as component bar charts, layered line charts, back-to-back bars, and superimposed charts, are notoriously difficult for the mind to process and prone to misinterpretation.

Checklist for choosing the right graph					
	✓ Useful	✓✓ excellent	<i>Recommended chart</i>		
	bar	line	pie	histogram	scattergram
<i>For data showing</i>					
Parts of a whole	✓✓		✓		
Changes over time	✓	✓✓			
Frequency distribution				✓	
Correlation					✓

Strengths and weaknesses of types of graphs

Type	Strengths	Weaknesses
<i>High impact graphs</i>		
Bar	Direct, vivid; easily understood.	Data may appear too obvious.
Line	Direct, vivid; easily understood.	Purists argue that linking data by lines implies a connection and that non-continuous data should be on a bar graph.
Pie	Simple if kept to five or fewer slices; people love them.	Difficulty in comparing items in a circle; very difficult to compare data across two or more pie charts.
<i>Other graphs</i>		
Histograms	Measures frequency more successfully than a standard bar chart or table.	Easily misinterpreted; unfamiliar to many readers. Simple design and succinct explanation are essential; vulnerable to inadequate labelling.
Scattergrams	Measures scatter of occurrences vividly. Excellent in the Discovery Stage of work.	Often overwhelms readers; unfamiliar to many users. Message is often lost. Good explanatory title is essential.
<i>More complex graphs</i>		
Component bars	Provides comparisons and cumulative totals.	Subject to distortion and misinterpretation. Cumulative data becomes difficult to compare. Often fails to make an impact.
100% stacked	Provides unit comparison and totals.	Overloads readers with unimportant data; rarely vivid or memorable. Subject to distortion and misinterpretation.
Layered line	Tries to supply relative and total comparisons.	Volume comparisons are subject to gross distortion. Overloads readers with unimportant data.
Back to back	Compares positive and negative data. Vivid if kept simple.	Comparative data are separate, inviting confusion and lessening impact.
Multi-column bars	Shows breadth of data. Useful in the Discovery Stage for categorizing items.	Unfamiliar to most readers. Categories may be unclear. Anonymous bars beg identification. Title must be crystal clear.
Spider-graphs	Shows performance and compares different aspects of performance.	Too complex for the average reader. Demands comparison of items in a circle. Labelling is crucial to helping readers understand.
Super-imposed graphs	Allows comparison of two different sets of data.	Confusing for many readers; people often misread the scales and misinterpret the information. Ensure you are making a valid comparison. Labels and titles require care.

High Impact graphs

Bar graphs

4.2 Use basic bar graphs to compare items or parts of a whole. Simple horizontal and vertical bar charts are versatile and easy to understand (Figures 4 and 5).

Design tips

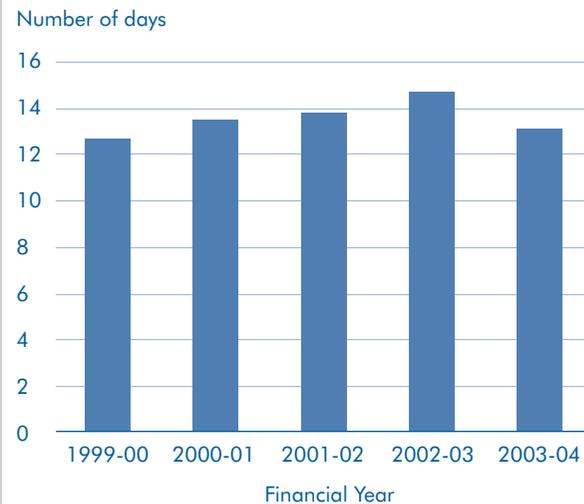
- Arrange bars in size or other logical order.
- Broaden bars for greater impact.
- Vertical and horizontal bar charts are equally easy to comprehend, but horizontal charts are easier to label.
- Readers expect money and time to be vertical.

Paired bar charts

4.3 Paired bar charts allow for two-way or grouped comparisons (Figure 6). A series of paired bars is more effective than stacked bars. In a series, the information on the Y and X axis is repeated, facilitating the comparisons. The choice of comparisons is crucial to paired bars. In figure 6 below, readers can be encouraged to compare treatment types or compare ages. Experiment to ensure the grouping highlights your message.

4 Vertical bar chart

The average number of working days per person lost due to sickness absence increased between 1999-00 and 2002-03 and decreased in 2003-04.

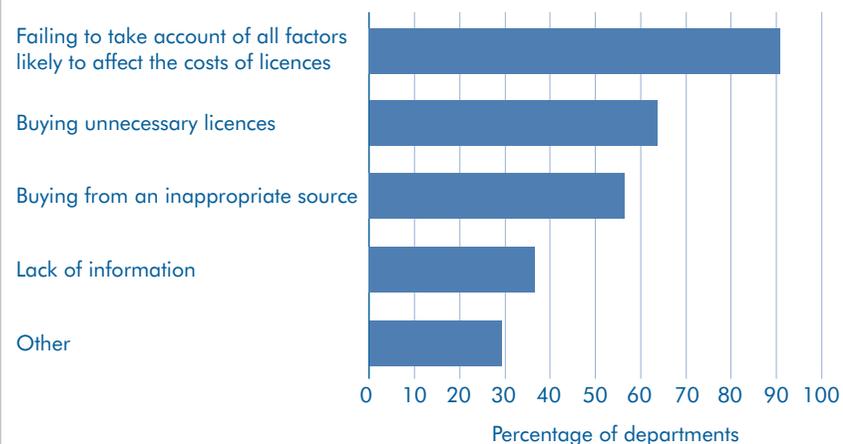


Source: National Audit Office analysis of Prison Service data



5 Horizontal bar chart

The main risks to value for money that departments face when purchasing software licences are: failing to take account of the full range factors that affect price, buying unnecessary licences and buying from an inappropriate source.

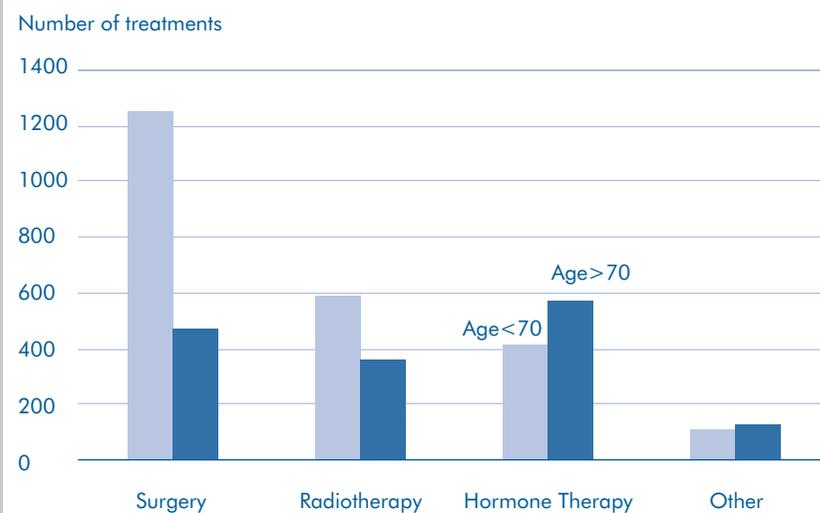


Source: National Audit Office survey of departments. Fifty-five departments provided information on this question and could tick more than one option



6 Paired bar chart

The pattern of treatment given to prostate cancer patients diagnosed in 2002 with PSA score of 0-10 varies with age.



Source: British Association of Urological Surgeons cancer registry and National Audit Office



Pie charts

4.4 Pie charts show parts of the whole. They display broad comparisons in a friendly manner (Figure 7). However, experts point out that pies require readers to compare data in a circle, when most of us think linearly. Avoid comparing two or more pie charts; distortions inevitably occur. A bar chart or a table is often a better way to show this information.

Design tips

- Keep to fewer than five slices. Research demonstrates that with more slices readers estimate the sizes incorrectly. Additionally, the chart loses impact and is difficult to label.
- Arrange slices in size order, largest to smallest, beginning at 12 noon.
- Label slices individually – don't use a key legend.
- Include the overall volume or quantity in the title.

Line graphs

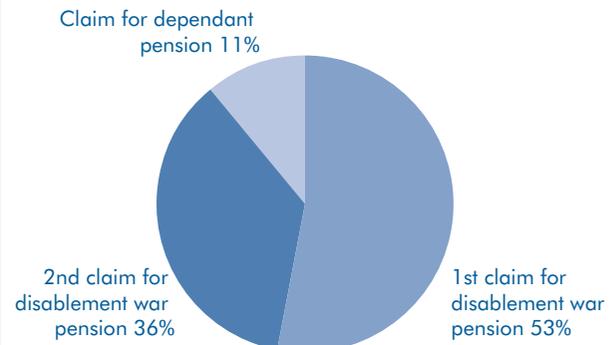
4.5 Use line graphs to show changes in a series, usually over time (Figure 8). Any linear measure, such as accidents per miles driven, can be shown in a line graph. Line graphs are underused. They offer a clean, elegant, representation that is both dynamic and easily understood.

Design tips

- Limit the chart to five lines. Line graphs soon become crowded and indecipherable.
- A minimum of three points is needed to demonstrate a pattern.
- Place labels on lines themselves; key legends add clutter.

7 Pie chart

27,075 claims for war pensions received.

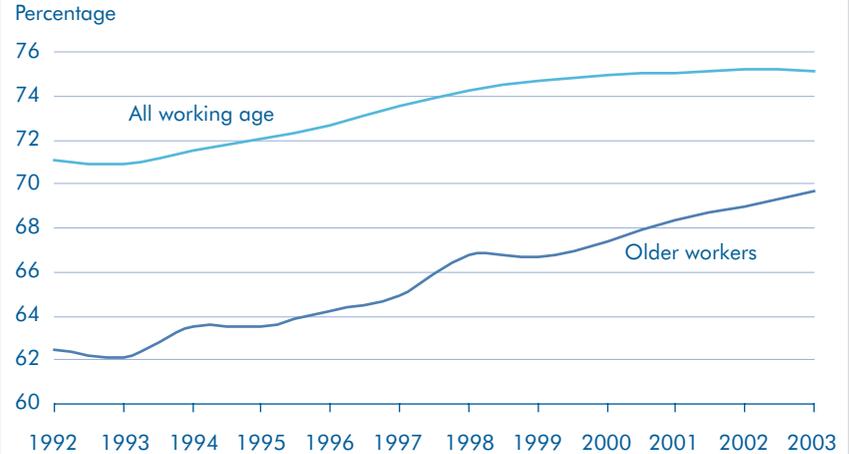


Source: National Audit Office analysis of data



8 Line graph

The proportion of older people in work is lower than that of working age people in general.



Source: Labour Force survey

NOTE: To assist clarity percentage scale does not start at zero.



Other Graphs

Histograms (frequency distribution charts)

4.6 Histograms (or frequency distribution charts) summarise vast amounts of data that fall into numeric ranges or categories. They resemble bar graphs except that each bar represents this range and collects a number of observations rather than independent values (Figure 9). Readers are likely to be unfamiliar with histograms. Clear interpretation of the graph in the titles, subtitles and labels is vital.

4.7 The x-axis measures the range of the category (1-5, 6-10, etc.); the y-axis measures the count of observations (the frequency). Most presentation histograms (rather than analytic ones) have standard ranges, making the bar widths, along the X-axis, uniform.

Design tips

- Ensure axis labels are clear and coherent to readers.
- Choose between five and twenty categories. (Fewer than five gives no discernable pattern; more than twenty is unwieldy.)
- Histograms are drawn vertically, rather than horizontally.
- Make sure readers understand what the histogram indicates. Use the sub-title to ensure readers understand the graph's message, for instance: "Most staff earn less than £31,000 per year".

Scattergrams

4.8 Scattergrams reveal relationships by displaying a number of points. They present large amounts of data in an organised way (Figure 10). Scattergrams may be more useful in the discovery stage of your work, but they may also occasionally appear in VFM reports.

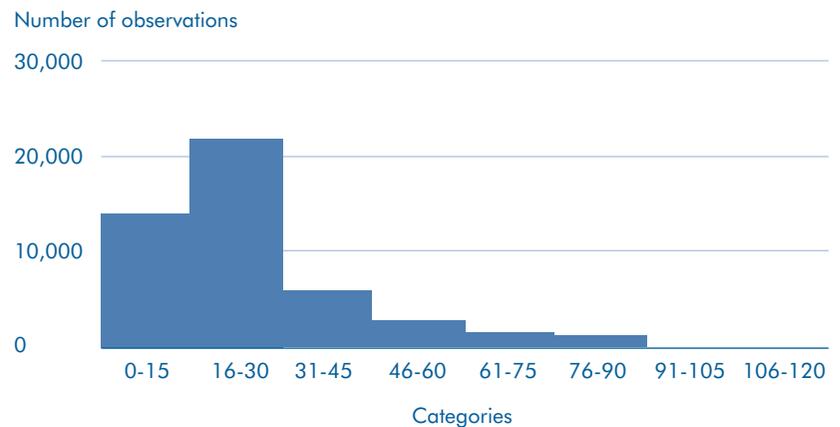
Readers are likely to be unfamiliar with scattergrams. Directions from titles, subtitles and labels are crucial.

Design tips

- Label scales carefully.
- Trend lines are optional.
- Many readers will not know how to interpret a scattergraph. Be sure to explain its conclusions. For example, the sub-title could state: "This scattergraph shows a positive correlation between percentage discounts offered and number of sales".

9 Histogram

Use the subtitle to ensure readers understand the graph's message.

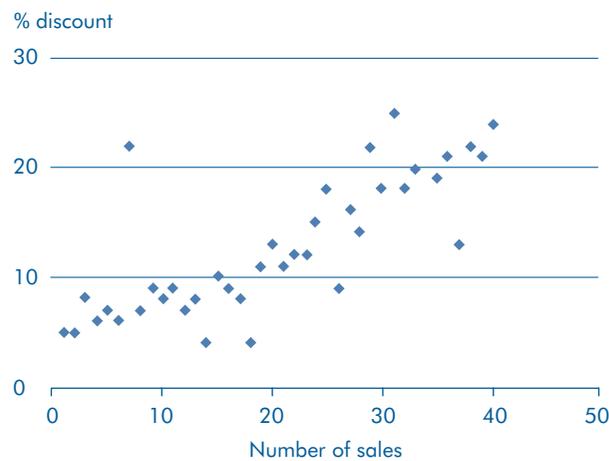


Source: National Audit Office analysis of data



10 Scattergram

This scattergraph shows a positive correlation between percentage discounts offered and number of sales.



Source: National Audit Office analysis of data



More complex graphs

4.9 Current VFM reports include other graphs such as component bar charts, 100% stacked bars and layered line charts. However they are used as a means for showing large amounts of data and demand practiced interpretation that a lay audience does not have.

These graphs often attempt to perform two functions at once: to show both the total and the parts. Graphs are most successful when they convey a single message. They should not be puzzles for readers to work out, but a vivid statement.

4.10 The table opposite analyses some of the problems associated with more complex graphs. Before employing these types of graphs consider:

- What is the message?
- Does this chart communicate that message?
- Is there a simpler method of getting the message across?

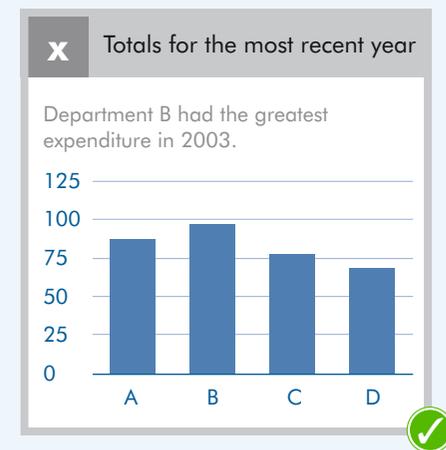
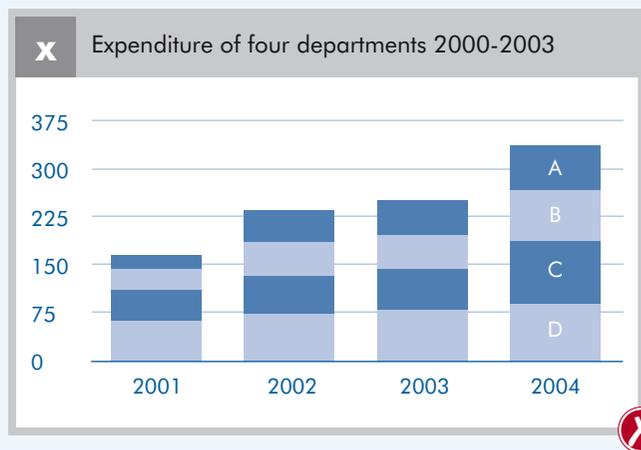
Remember, graphs are not good at detail but they relay simple messages in a powerful and memorable way (see Examples 13 and 14).

Problems associated with more complex graphs

Issue	Disadvantages	Graph types	Alternative
Multiple comparisons	Lack of focus; abundant data disguises trends and exceptions; message becomes blurred	<ul style="list-style-type: none"> ■ component bars ■ 100% stacked bars ■ multicolumn bars ■ layered line graphs ■ spidergraphs ■ superimposed graphs ■ Box and whisker plots 	<ul style="list-style-type: none"> ■ several small graphs ■ line graphs ■ tables
Area comparisons	Distortion; hidden or uneven baseline; area perception is notoriously inaccurate	<ul style="list-style-type: none"> ■ component bars ■ 100% stacked bars ■ multicolumn bars ■ layered line graphs ■ spidergraphs ■ superimposed graphs 	<ul style="list-style-type: none"> ■ several small graphs ■ line graphs ■ tables

Example 13: Component or stacked bars

Component (or stacked) bars compare both the overall size of the item and the size of the individual segments.



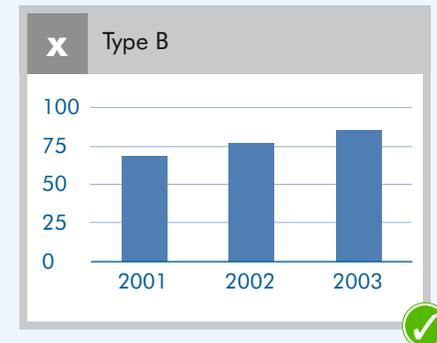
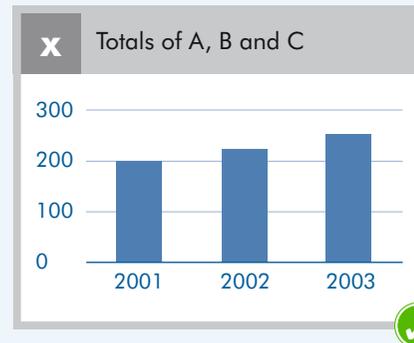
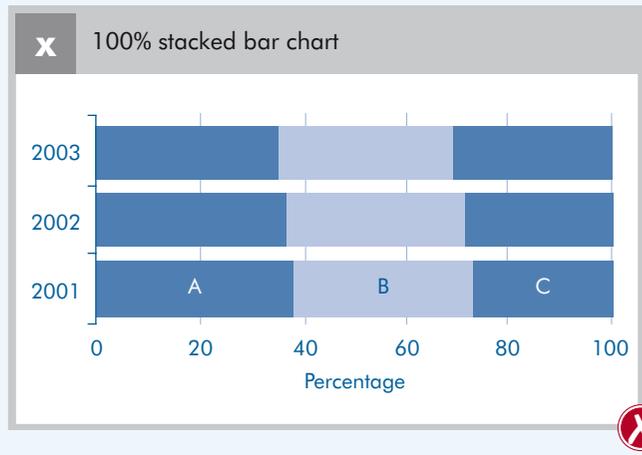
Often there is no advantage in showing all the data. If essential, the data can be presented in a simple table or on two (or more) simple charts. A selection of the data may provide a memorable graph. For instance focusing on yearly totals (in the second graph above) or showing the totals for the most recent year (in the third graph above) creates lucid graphs.

Example 14: 100% stacked bar charts

These resemble component bar charts, but the segments are percentages and bars always equal 100%.

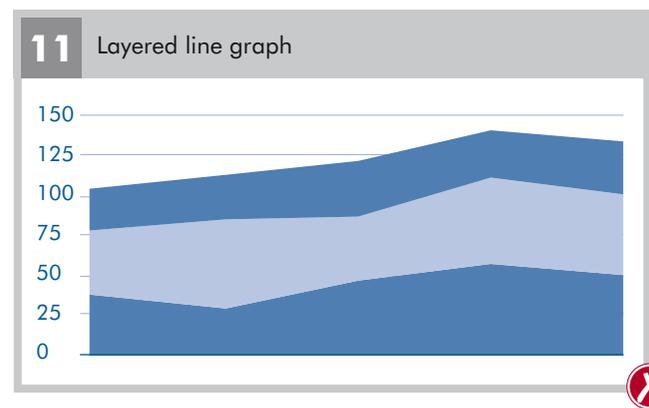
Two or more stacked bars are often presented, but with a uniform total (100%) and variously sized segments, distorted interpretation is almost inevitable. In the example below, try to compare the size of the middle sections. Are 2001 and 2003 equal?

A table can often present this data more clearly. Alternatively, showing only a selection of the data can create powerful, lucid graphs. For instance, showing the totals for the three years or, changes to just one item over the three periods:



Layered line charts

4.11 Layered line charts share the problems of component bar charts. Readers cannot distinguish the upper segments because the bottom portion necessarily distorts them. These charts attempt to show both the total change for the period plus changes in each component of that total. Two graphs – one for each purpose – would be more successful.



Back to back bar charts

4.12 Back to back bar charts break a classic design rule: things to be compared should be close together. By placing comparable bars in opposite directions, lengths cannot easily be compared. Showing positives and negatives on the same bar can be satisfactory. Setting them on two bars, as shown in **Figure 12**, clutters and confuses the graph's overall purpose. Simple graphs convey meaning more easily.

Multicolumn bar charts

4.13 The problem with these graphs is that frequently they fail to make a decisive statement (see **Figure 13**). They are vague, need to be studied to be understood and readers have no idea what the message is. They can successfully communicate numeric ideas if kept basic and where the title makes explicit their message. For instance: "Many organisations have too few IT staff to do the job adequately." It is often easier to put the data into categories and present it as a table or a simple bar chart.

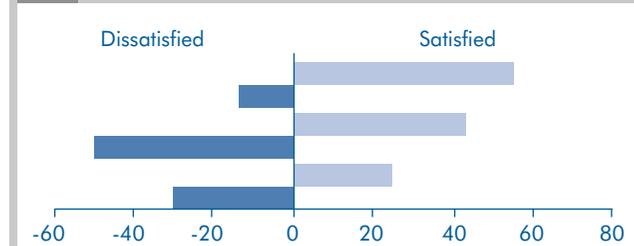
Spidergraphs (radar or pentagon graph)

4.14 The spidergraph is a sophisticated graph that, when studied, can yield useful information about performance in areas of interest (see **Figure 14**). It is an unfamiliar graphic to the general reader, so if you wish to include one, tread carefully and ensure that the graph is clearly explained. An intimidating graph may not only fail to convince the audience of their own message, but could discourage readers from continuing with the report all together.

4.15 If you do wish to use a spidergram, consider the following design issues:

- Label lines individually; don't use a key legend.
- Unlike simple graphs, the meaning is not immediately obvious, so be sure that the sub-title explains its message. Readers should be in no doubt if the results are positive or negative.

12 Back to back bar chart



13 Multicolumn bar chart

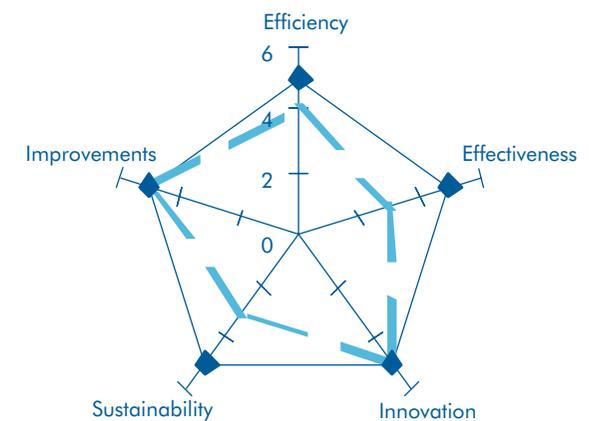
Many organisations have too few IT staff to do the job adequately.

IT staff per 1,000 employees



14 Spidergraph

The Department rated highest in the areas of improvements and innovation.



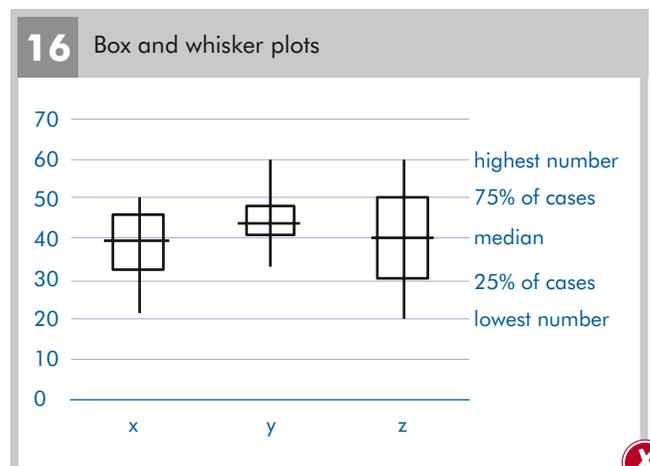
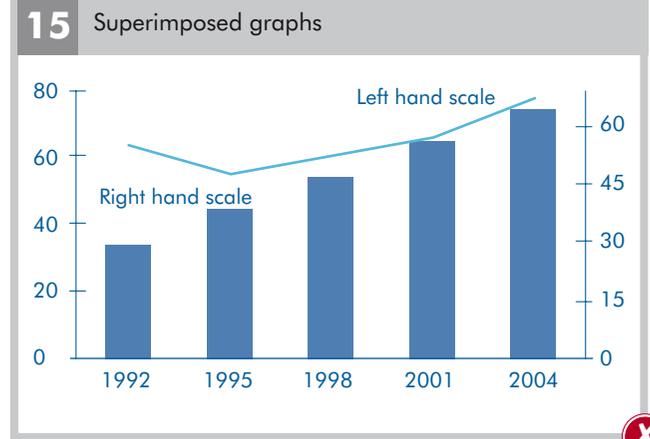
Superimposed graphs

4.16 These show the relationship of two sets of data working to two separate scales, usually line and bar graphs (see Figure 15). These graphs can be helpful at the Discovery Stage, but are less satisfactory in conveying an explicit point to readers. One obvious problem is that readers often confuse the two axes. Often it is more effective to place two graphs side by side.

Box and whisker plots

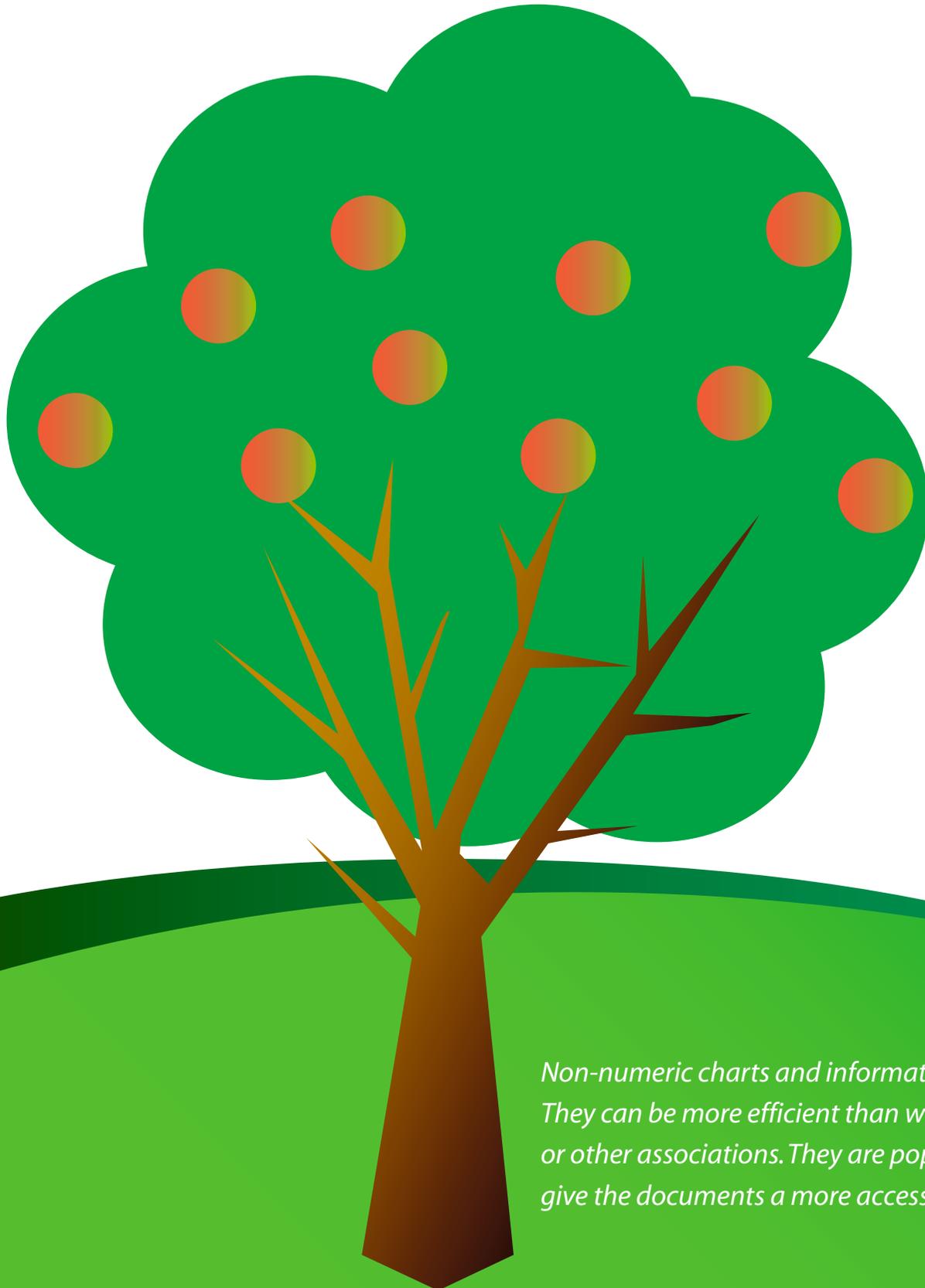
4.17 These summarise the distribution within a dataset. They are a relatively new type of graph and many variations can be found. Their technical appearance can be off putting to readers (see Figure 16).

Plots contain too much detail to convey a vivid statement. They may be more useful during the Discovery Stage than later. A simple bar chart (or two) may get your point across more effectively.



Part 5: Presenting non-numeric charts

This chapter covers a selection of non-numeric charts and information graphics regularly used in National Audit Office reports.



Non-numeric charts and information graphics visually structure information. They can be more efficient than words for illustrating relationships, processes or other associations. They are popular with readers of NAO reports and they give the documents a more accessible, friendly look.

Getting started

5.1 The first task is to select or devise the right format for the message; as always, you must know your audience and your purpose. The subject expert, author and graphic artist must work together to develop an accurate, imaginative, and relevant visual. Consult with the Design Group as early on in the process as possible. This will maximize flexibility in producing the most appropriate graphic.

5.2 Organisational and flow charts originated from the need to track information rather than the desire to convey it to others. To use such charts to communicate information titles, labels, and symbols must be explicit.

General points

5.3 There are some general considerations when developing conceptual charts and information graphics:

- **Obtain thorough information:** Designing these visuals demands a thorough understanding of the organisation and process.
- **Rely on the classics:** Inventing a new graphic scheme for information is almost impossible. New formats are usually complications of archetypal ones. Best practice suggests using classic designs. To quote Professor Tufte: "Don't get it original, get it right."
- **Give yourself time:** Information graphics take time to develop. Even a seemingly simple chart can require several versions, as different ideas are proposed and checked by the study experts and authors (and as the lack of thorough information becomes apparent in the versions).
- **Collaborate:** Talk to colleagues, look at other publications (for instance, The Economist), speak to the Design Group.
- **User testing:** To ensure that the graphic conveys the intended message, show it to colleagues. Ask them to describe what they see and what message they get from it. Members of the study area are likely to be familiar with related subjects, so the ideal test audience is members of alternative study teams or members of the educated public. Be aware of confidentiality issues however when consulting externally.

Common problems

5.4 Four common problems bedevil non-numeric graphics:

- Ambiguous purpose, including hybrid charts
- Indistinct start points, direction arrows, and end points
- Unnecessary clutter
- Vague titles and labels.

Ambiguous purpose

5.5 Subject experts and report authors, as well as graphic artists, may be unsure of the purpose when they first consider a chart. It takes time to develop a purposeful, coherent graphic.

5.6 One of the most common mistakes is to merge organisational and flow charts, and to add other functions (numeric data, decision points) to maps, diagrams and conceptual charts. Two or three simpler illustrations each covering discrete areas is best. Be vigilant.

Indistinct start points, direction arrows, and end points

5.7 Start points should always be at the top, or left of the chart. A surprising number of charts fail because they want readers to start from the bottom or lower right.

5.8 Arrows should clearly lead from one item to another.

Clutter

5.9 Clutter consists of chart junk, unnecessary details and superfluous design elements (shapes, colours, and meandering arrows). It hides the information you want to emphasise. The reader cannot grasp the overall message easily. Keep the graphic as free from clutter as possible.

Vague titles and labels

5.10 In VFM reports, the purpose should be stated in the title of each graphic. As with numeric charts and tables, the title guides the reader. Titles should include purpose, context information, highlights, date, area and scope.

In the following titles the revised version gives comprehensive information with a clear purpose.

Original

Working Group

Funding approval process

Revised

Structure of Interdepartmental Working Group, with agency identification, Ministry of X, 2004

Approval Process, Special Projects Funding, with bottlenecks noted. Ministry of X, 1999-2004

5.11 Labels can be weighed down by detail, rendering them incomprehensible. Keep them succinct. Stick to essential information and provide details elsewhere, in the title or in the text.

The original label below is too long. Such labels quickly clutter the chart. The revision (position title only) is sufficient.

Original

Co-ordinator, Children and Youth, Mary Smith (2004), responsible for public strategies and promotion

Revised

Co-ordinator, Children and Youth

Conceptual Charts

5.12 NAO publications use conceptual graphics—flow charts, advance organisers, and organisational charts—to organise non-numeric information visually. As with all illustrations, the message is encoded through layout. For example, an organisational chart tells us more than a list of job titles because its structure makes supervisory and reporting relationships visual.

5.13 There are numerous types of conceptual charts, three of which commonly appear in VFM publications and are discussed in detail below:

- **flow charts** use sequence (sometimes cycles) to represent movement;
- **organisational charts** use hierarchy to describe personal and departmental associations;
- **advance organisers** present a central idea with supporting sub-categories, like indentation in a table of contents.

How to develop and design flow charts

5.14 Flow (or process) charts display sequential events, steps in a process or functions in an organised fashion. They originated in engineering and manufacturing. When designed by insiders, the charts can support complex relationships because users are familiar with the process. A large vocabulary of symbols has developed for flow charts, but only the most common such as arrows are widely known.

5.15 Flow charts can give an overview (how a bill passes through parliament) or concrete steps (how to brew tea). They are good companions to organisational charts.

What goes wrong?

- Flow charts easily become overly complex. Careful consideration of purpose—of what process is being described—can avoid this. Purpose will help limit each chart to one sort of movement (e.g., equipment or people; the applicant's journey through a system, rather than the system's internal actions).
- Mixed purpose (such as found in flow and organisational chart hybrids, or several sequential processes in one chart) result in overly complex charts that are unnecessary, difficult to grasp and off putting to readers.
- Obscure terms and symbols (or detailed legends translating the symbols) will befuddle users.
- Steps are easily omitted or merged. Poor analysis and over-familiarity with the subject are leading causes of this problem. Often, flow charts are devised because the material itself is complicated and text explanations become convoluted. Isolating the steps is a crucial but difficult task.

Design tips

5.16 Designing an accurate flow chart requires a deep understanding of the process. Creating a good flow chart almost always takes longer than anticipated. Speak to the Design Group as early as possible.

- **Select a simple design:** Start at the top or left; that is logical.
- **Keep arrows and directional signs simple:** The occasional diagonal arrow is necessary; several of them betray a poor chart design. Research suggests that arrowheads are preferred to terminal points and plain arrows are preferable to block or triangular ones.
A plain diagram can show arrows in two directions (e.g. collecting information and reporting back). Reciprocal arrows are valuable when the relationship is genuinely mutual.
- **Delete values:** Flow charts are about the movement, not the quantity. Including numbers will distract your reader and neither values nor flow will be remembered.
- **Compose labels carefully:** Readers will not wade through complex sentences or long entries. Limit labels to identification. Titles and subtitles can expand on the subject.
- **Use verbs:** Words like *receive*, *manage*, *implement*, *approve*, *perform*, and *respond* tell the reader what is going on. Arrows alone can be ambiguous; verbs are specific.
- **Use multiple charts:** The complexity of flow charts is a major problem. Two or three simple, lucid charts are worth more than a large, single confusing chart.

“ Perfection is achieved not when there is nothing more to add, but when there is nothing left to take away ”

Antoine de Saint-Exupery, author

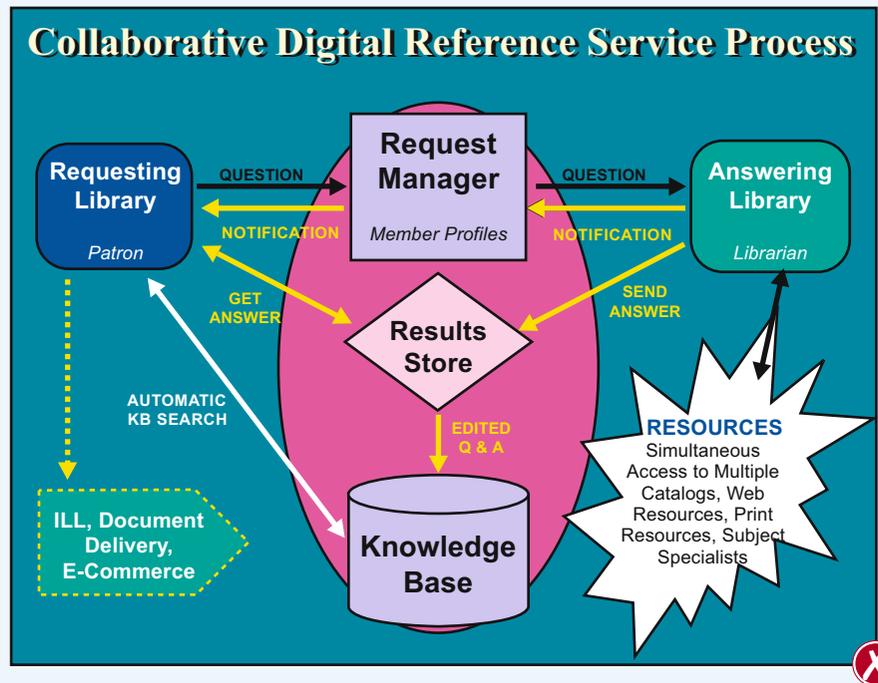
Example 16: Improving a flow chart

This example, from the US Library of Congress, represents an electronic information service among libraries. The designer has obscured the flow with odd shapes, several fonts, and garish colours.

Once these distractions are removed however, problems persist:

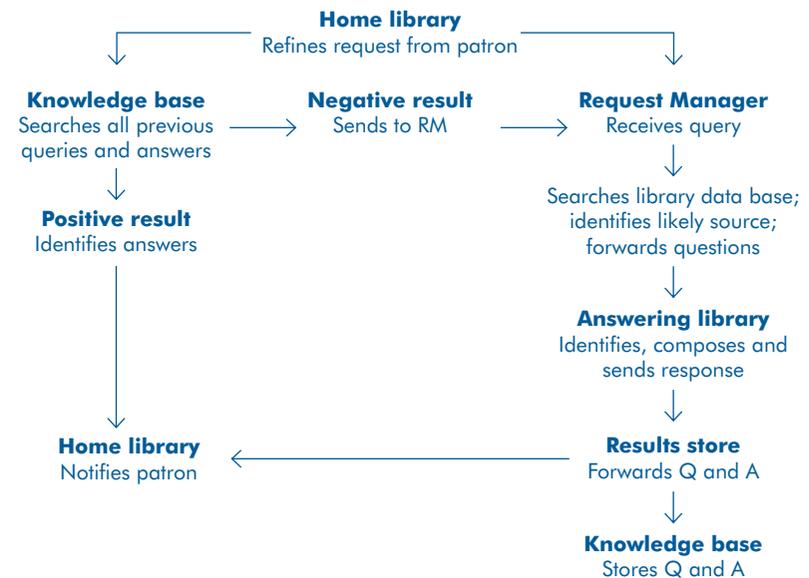
- **Failure to consider the audience:** Terms are not defined. It is likely that the author's familiarity with the material has led him/her to draw a graphic incoherent to others.
- **Items and relationships are ambiguous:** The layout and text conspire to confuse. Numerous lines and arrows show connections without clarifying what goes on. Is the Request Manager a pipeline without additional function? What is the meaning of *Document Delivery, E Commerce* in the left corner?
- **Arrows are ambiguous:** They are overused, without providing clear information. Is the information in the starburst an explanation of sources from the Answering Library, or some other entity? How do the Patron and Knowledge interact?
- **Vague titles and labels:** The tasks of the Request Manager, Results Store and Knowledge base are indeterminate; the role of *documentary delivery and ecommerce* is mysterious.

The revised flow chart shows a greatly improved and simplified layout.



X Collaborative Digital Reference System

Request and Response process, 2003.



How to develop and design organisational charts

5.17 Value for money reports often examine complex activities, especially relationships among organisations, such as a corporation, government department, funding agencies and advisory panels. Organisation charts portray these relationships within such a group. They are assumed to be hierarchical, showing direct lines of authority and responsibility (see Example 17).

5.18 If the organisation enjoys a strict hierarchy, designing the chart is also straightforward. Frequently however, organisations get their work done through cross-management, informal arrangements, temporary assignments, non-subordinate relationships, and indirect reporting. These are, of course, harder to depict, and require more thought.

Illustrating relationships

5.19 Organisational charts set out formal relationships in a variety of ways. For Marks & Spencer, we might imagine:

- titles and reporting relationships: chief executive, human resource director, regional managers, store managers, procurement directors,
- major units: clothing, financial services, food, household goods,
- functions: finance, marketing, transport, public relations, sales, IT, etc.

Select one such grouping per chart.

Principles

- **Stay with a classic structure:** As soon as you introduce a circular or arrow-pointing design, you're in the realm of a flow chart.
- **Limit the information:** Demonstrate relevant, rather than comprehensive, information. A series of narrow, lucid charts is preferable to a single confusing chart.
- **Snapshot, not animation:** Of course, organisations change and individuals bend jobs to their talents and interests. Design charts to portray the structure at a point in time and identify it as such (e.g. "as at April 2004", etc.). For "before and after" structures, employ two clearly titled charts.

Design tips

5.20 Consider the following when drawing up organisational charts:

- **Supervision and reporting:** The classic organisational chart covers both of these at once. In modern organisations things are more complex. A few dotted or weighted lines (straight, never meandering or with sharp turns) can often be used to distinguish relationships. If the chart gets too busy, split it into two. Repetition is preferred to confusion.
- **Title completely:** Give a full explanatory title, with date. If needed, elaborate in a full subtitle.
- **Avoid arrows:** Define reporting by the layout. Few connecting lines and arrows should be necessary.
- **Avoid borders:** Underline or lightly shade the position titles. Let layout, rather than clutter, guide the eyes.
- **Keep it simple:** As always, avoid clutter and chart junk.

How to design advance organisers

5.21 Advance organisers, or orientation charts, introduce readers to a subject. They may give an overview of an area of interest or a close-up. These charts visually order component parts into a whole. They closely resemble organisational charts, but have a wider reach (beyond the organisation) and more freedom (not hierarchical). VFM reports use advance organisers to present:

- The structure of the report (but not the structure of the agency or department under study)
- A topic's social or economic environment (such as causes of crime, pressures on public-private partnerships)
- The functions of an agency or particular initiative; often a subgroup or cross-disciplinary group
- The outreach or ripple functions of a department or initiative.

5.22 Devising a format that is both structurally sound and fresh is difficult. Though standard formats may appear derivative, a classic diagram is preferable to introducing odd colours, shapes or directions. The simplest—and often the most effective—advance organisers present a list in a dynamic visual manner. Advance organisers can carry some (limited) decoration. They are meant to attract as well as inform the reader.

Selecting Information

5.23 Because they are introductory, advance organisers need simplicity and immediacy. Each component must be clearly understood by itself and as part of the whole (see Example 18 overleaf).

Design tips

5.24 For the most part, advance organisers follow the guidelines for flow and organisational charts:

- select a simple design
- keep arrows and directional signs simple
- delete values
- compose labels carefully.

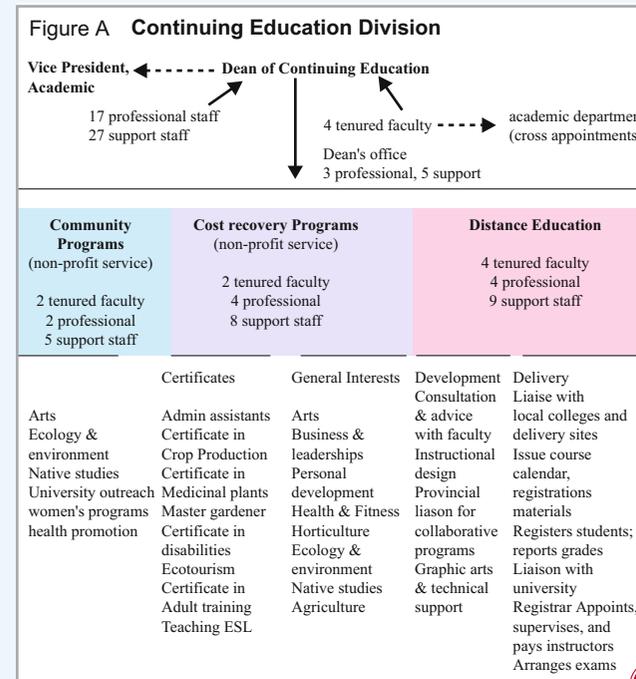
Example 17: Improving an organisational chart

This chart depicts a department of a North American University.

The first version opposite attempts too much. It presents

- reporting lines (including faculty who have cross-appointments)
- staff allocation (numbers and type)
- detailed functions.

The solution is to create two charts (below), each focusing on a single message.



X Staff allocation, Continuing Education, 2004

17 professional staff; 27 support staff; 4 cross-appointed faculty.

Cost Recovery Programs	2 faculty 2 professional 5 support
Community Programs	2 faculty 4 professional 8 support
Dean's Office	3 professional 5 support
Distance Education	4 professional 4 term professional 9 support

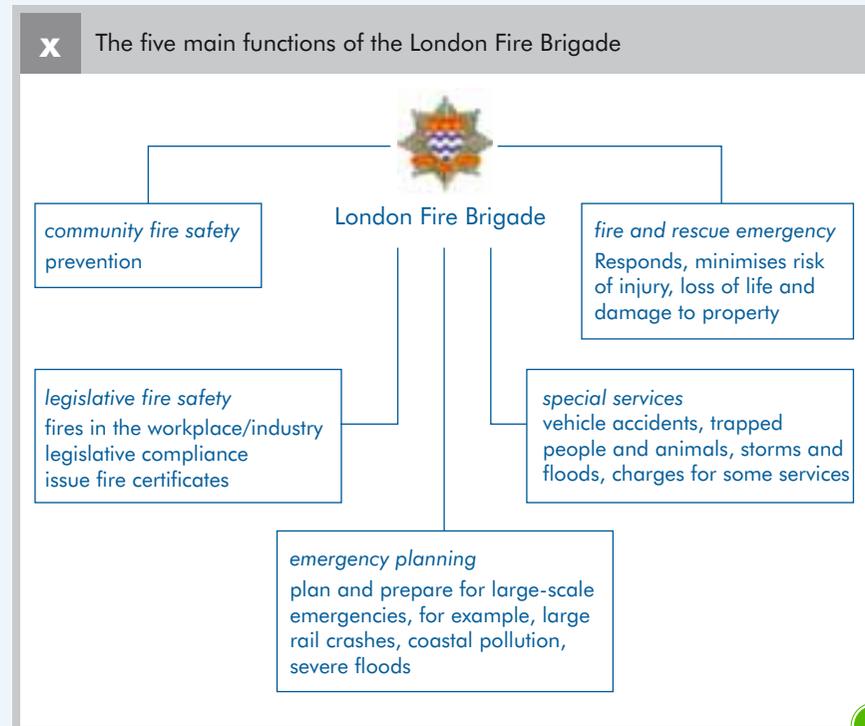
X Reporting lines in the Division of Continuing Education Division, 1999-2004

Dean of Continuing Education				
Director, Community Programs <i>Secretary to Director</i>	Director, Cost Recovery Programs <i>Secretary to Director</i>	Director, Distance Education <i>Secretary to Director</i>	Manager, Distance Delivery <i>Secretary to Director</i>	Office of the Dean <i>Secretary</i>
Program Manager Development <i>Admin Assistant Clerk</i>	Program Manager Development <i>Admin Assistant Clerk</i>	Program Manager Development <i>Admin Assistant Clerk</i>	Instructional Designers <i>Editor Data Clerks</i>	Business Manager <i>Accounting Admin Assistant</i>
Program Manager Delivery <i>Clerks Faculty Advisors</i>	Program Manager Delivery <i>Delivery Assistant Clerks Faculty Advisors</i>	Program Manager Delivery <i>Clerks</i>	Manager, outreach and contracts	Marketing <i>Webmaster Designer</i>

Example 18: Advance Organisers

A simple advance organiser

A discussion of firefighting could use the following, which gives the five main function of the London Fire Brigade, arranged around the Brigades' shield. Each component could be repeated as a major heading in the report.



Problems in an advance organiser

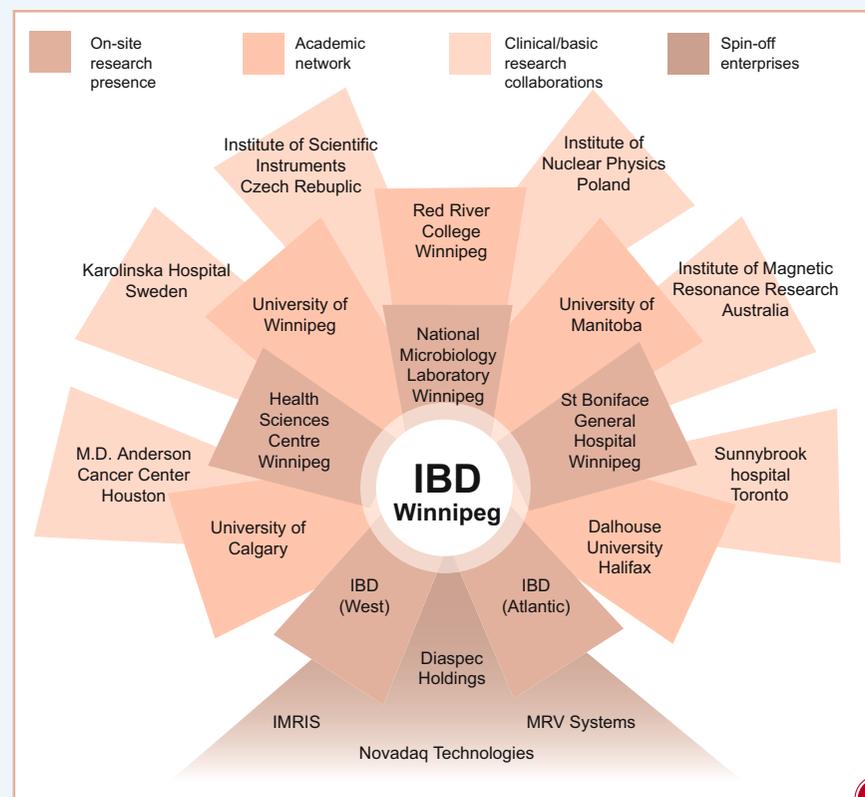
The Institute for Biodiagnostics (IBD), part of the National Research Council of Canada, develops medical devices and techniques. The chart below appears on their web pages without a title, under the section "Collaborations".

This graphic shows too much information with not enough order. It includes external partners, sister organisations, commercial off-shoots, and geographically-separated internal units, as well as categories and geographic reach.

It seeks to organise the information through shading (for categories) shape (for some categories), proximity (for geographic distance) and text (for names and locations).

Finally, the odd-shaped leaves (or stubby arms?) seem to be trying to represent dynamic activity. This attempt fails under the weight of specific information.

All of these dimensions cannot coherently be shown on the same chart. A simple text table would communicate more information; or perhaps several smaller, more specific charts.



How to present maps

5.25 Maps naturally show proximity and geographic order. They are constructed through measurement yet we don't think of them as numeric visuals. When used to identify the distribution of service across England, the location of industries, or the spread of pollution, etc., maps rely on the readers' knowledge of population, history, weather, economics and politics. When considering maps, think about the following issues:

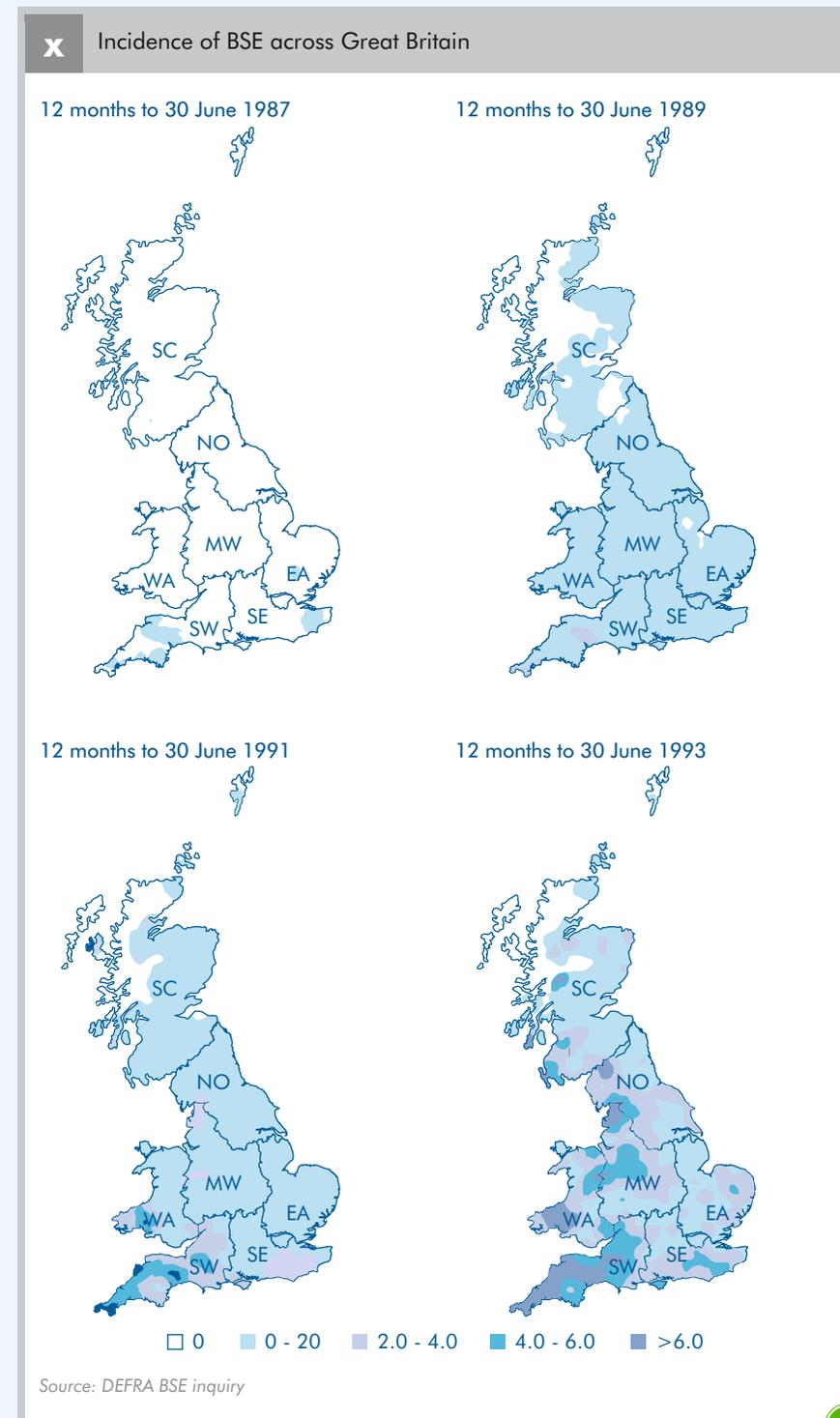
- Is there justification for using a map rather than a list? Maps show certain comparisons, such as concentration in a geographic area (the comparison in road maps is distance and direction; in world maps, it is commonly proximity and size of nations). They can also compare natural resources, such as fisheries.
- The NAO audience knows UK geography; so place names, county lines, roads and rivers, may not be necessary.
- Focus on the featured comparison. If the discussion concentrates on one area, restrict the map. Select a map of Cornwall rather than all of Great Britain.
- Speak to the Design Group early on. Maps don't usually need to change much and early contact can be an efficient use of time.

Design tips

- Use simple and relatively few symbols.
- Use shading to signify differences.
- Use colours thoughtfully. In addition to usual problems of colour-blind readers and reproduction, colour has political and emotional connotations. Maps of the Middle East have been withdrawn because an Arab country was coloured blue (which signifies Israel in the region).
- Avoid charts on maps. These clutter the map. Use maps for geographical purposes and place companion tables and charts nearby.
- Keep location markers consistent: Do not signify variables through the height or width of markers (e.g. population of elderly by size of bullet). Most readers cannot estimate size.
- Do not distort shape to carry information. Some maps vary shape to demonstrate relative rates or quantities. (The greater the number of school children or income per household, the larger the map area). As with pie, area, and pictorial charts, humans are simply not good at comparing areas.

Example 19: A good use of maps

The BSE inquiry provided a series of maps charting the disease and powerfully demonstrating its spread and eventual decline in the UK. The original has thirteen small maps tracing the incidence from 1981 to 1995. We've reproduced a sample in the figure below.



How to present diagrams

5.26 A diagram is a sketch showing the structure, framework or parts of an item or thing. It should function as a simplified plan (See Example 20 below). Diagrams are used to explain matters small and large (the parts of an atom, the skeleton of a dinosaur), and static and dynamic (the floor plan of a house, the solar system).

The readers' point of view

5.27 The most common complaint about diagrams is that they are impenetrable: designed by, and accessible only to, those already familiar with the subject. Be clear about what your diagram should show and design from the point of view of the user. Design for an audience that knows little or nothing about the subject.

Design tips

- As with graphs, use the title to explain what readers should see in the illustration.
- Label important details. If the diagram has several parts (insets as in maps or steps as in DIY instructions), repeat labels rather than assume the transition is obvious.
- Test the diagram on a sample audience.
- Show the minimum. Avoid extraneous information and clutter.

Example 20: A clean diagram

This diagram does not use labels, but it does show the parts of the house discussed.

X Two typical packages of measures offered by Warm Front

A package of measures can result in considerable annual savings.

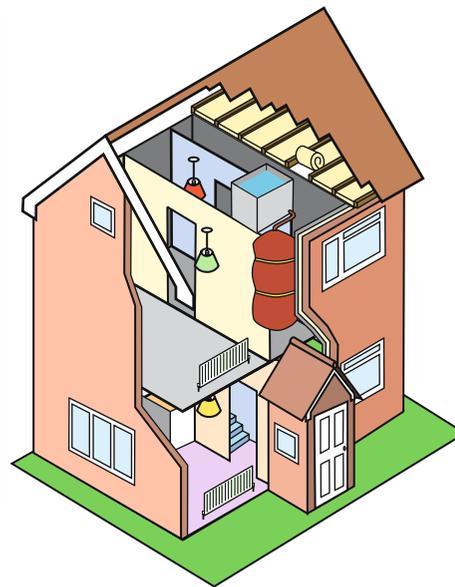
Warm Front example

Before: Semi-detached house with gas central heating and no insulation

Package of measures installed:

Loft insulation
Cavity-wall insulation
Draught proofing
Tank jacket and timer
2 Energy efficient lightbulbs

Potential saving £274 per year



Warm Front plus example

Before: Semi-detached house with main gas room heaters and no insulation

Package of measures installed:

Gas central heating (condensing)
Loft insulation
Draught proofing
2 Energy efficient lightbulbs

Potential saving £461 per year

Source: National Audit Office



How to present text boxes

5.28 Text boxes are separated chunks of text. In many VFM reports they are shaded to distinguish them from the surrounding prose and to give visual interest. They are useful for

- promoting a particular message
- presenting lengthy examples and case reports
- showcasing list information that might be lost in the page
- including non-essential but interesting information
- breaking up the page.

Design Tips

5.29 Text boxes are easy to design and use. Keep in mind a few points:

- Avoid gridlines and borders. Let the white space and layout establish sections and divisions.
- Use bullet points and bold sparingly. The natural rectangle puts a limit to the space and it can quickly grow crowded.
- Keep to a maximum of about half a page either vertically or horizontally. Larger text boxes lose impact.

Variants on text boxes

5.30 Text boxes are as versatile as text itself. They are ideal for checklists and directions. Extraneous information that must be deleted from flow, organisational charts and advanced organisers, often can be moved to a companion text box. Drawings, diagrams, or photographs can be judiciously inserted into text boxes. This is especially well done to make a list lively and memorable, as shown in [Example 22](#).

Example 21: A simple text box

A text table can emphasise and promote examples or case studies in NAO publications.

How pie charts got started

Although graphs have been around since at least the 10th century, **William Playfair (1759-1823)**, a Scottish political-economist, first developed pie charts. They appear in his book *The Statistical Breviary* published in 1801 and are used to show that the British paid more taxes than people from other European countries.

Pie charts grew in popularity and familiarity after around 1860 when **Florence Nightingale (1820-1910)** used them in her reports to Parliament to explain the causes of British Army deaths during the Crimean War. She is credited with being the first person to use graphs for persuading Parliament of the need for change.



Example 22: Text table with symbols

This popular layout is used for labels for hazardous materials. In a report, this text box could serve as an advanced organiser and each symbol and title repeated as a section heading. The repetition gives unity to the document.

X Hazardous product symbols		
	Corrosive	Eats at or wears away materials
	Flammable	Ignites if exposed to heat or sparks
	Explosive	Explodes or gives off deadly vapours
	Poison	May cause sickness or death if swallowed



How to present photographs

5.31 VFM reports use photographs primarily for design: to establish a mood, to create an effect, and to spur interest. They are usually cropped, tinted, and uncaptioned. All VFM reports have photographs on their covers and most include several photographs within them. Photographs are popular with readers, some of whom seem to study them more carefully than the text itself. All photographs must be what they purport to be; readers will notice otherwise.

Essential points

- Where photographs are used to demonstrate a point raised in the main text they should carry captions identifying the content and indicating the purpose of the photograph. This helps photographs play a more meaningful role in the report.
- Familiarise yourself with "Image quality specification for print" published by the Design Group and available on the *intranet* (<http://merlin/CorporateServices/icon/designgroup/choosingpics2.htm>). This gives complete and timely advice on sources of images, quality, scanning, using photographers, costs, royalties, etc.
- Speaking to the Design Group early in the project development will increase the likelihood of obtaining appropriate photographs.

Know your purpose

Photographs can play several roles. Generally three are common in VFM reports:

- **Stage-setting:** the photograph anticipates the theme or idea in the text. For instance, a photograph of pound coins does not, in itself, improve readers' understanding of the arguments for or against the Euro. But such photographs enliven the document.
- **Supplementary and complementary:** assists understanding of the text, though the link may not be direct.
- **Diagram:** a photograph with labelled parts can serve as a diagram. Construct the image carefully following the standards for diagrams.

An excellent example of the use of photograph captions is in *Fisheries Enforcement in England* (HC 563) 2002-03.

Considerations

- **Inadvertent messages:** Examine photographs closely in case they carry unintended messages, especially those that might be found offensive. Depressing or "gritty" photographs tend to be controversial, especially where recognisable individuals or locations are viewed. Take care that a photograph will not harm agencies or people seeking to improve difficult conditions.
- **Careful!** Examine photographs carefully. Is there a bare breast in the back of a group of swimmers? Is a sign misspelled? If something is wrong, count on readers to point it out!
- **Avoid public relations:** The other extreme consists of showing obvious "publicity shots" of overly glamorous surroundings or individuals. Many official photographs do this. Printing these is inconsistent with the NAO's independent role.

- **Present people:** Photos of people make our reports look friendly and more relevant to everyday life. Try to find shots that are fair, realistic and appropriate. Present an array of citizens: male and female, able-bodied and variously disabled, urban and rural, diverse ages, races and occupations.
- **Integrating photos with charts:** Never use photos as background images or to decorate information graphics. They can be valuable in text tables, and occasionally in diagrams.

How to present website screen captures

5.32 A screen capture of a home page or other webpage can be a helpful illustration in VFM reports. Depending on the site's own design, this can be a good graphic or a jumble. It is used primarily as relevant decoration, not as information, and therefore should not be large. That in turns means that information from the site is not readable. Web sites are frequently subject to change. Speak with the site's owner about their plans to ensure the most up to date version appears in the report. Always place the web address near to the screen capture.

How to present forms (or printed material)

5.33 The covers of forms and manuals, especially in a montage or array can provide visual interest while representing their subject. Headlines from newspapers and magazines give an idea of currency and public interest. Title pages of reports may be used the same way.

5.34 Forms that are of specific interest—say, the questions or methodology are being reviewed—may be reproduced in full and readable. The disadvantage of this material is that a montage can seem overpowering. The unintentional message is "This is all too much" or, in the case of government publications "What a lot of bureaucracy." Use carefully.

Checklist for non-numeric charts and information graphics

Can you answer "yes" about your non-numeric chart?

- Have you spoken to the Design Group as early as possible?
- Is there an explicit message driving the graphic?
- Is there an obvious starting point?
- Is there a comprehensive title?
- Are the labels lucid?
- Have you designed it from the readers' point of view?
- Is the chart self-explanatory (through the titles and the labels) so the reader does not have to refer to the text to understand the chart?
- Is the graphic free of extraneous clutter?

Sources

Books

- Bigwood, Sally and Spore, Melissa *Presenting Numbers, Tables and Charts*, Oxford University Press, 2003
- Billingham, Jo: *Editing and Revising Text*, Oxford University Press, 2002
- British Standard 7581: *The presentation of tables and charts*, 1992
- Chapman, Myra & Wykes, Cathy: *Plain Figures Second Edition* HMSO, 1996
- Ehrenberg, A.S.C. *A Primer in Data Reduction*, John Wiley & Son, 1986
- Harris, Robert L *Information Graphics: A Comprehensive Illustrated Reference*, Oxford University Press, 1999
- Kosslyn S.E., *Ghost's in the mind machine*, W. W. Norton & Company, New York 1983
- Kosslyn S.E., *Elements of Graph Design* W. H. Freeman & Co, 1993.
- Misanchuk, E.R. *Preparing Instructional Text: Document Design Using Desktop Publishing*. Englewood Cliff, NJ: Educational Technology Publications, 1992.
- Schrivier, Karen A.: *Dynamics in Document Design*, John Wiley & Son, 1996
- Tufte, Edward R: *The Visual Display of Quantitative Information*, The Graphics Press (USA), 1993
- Williams, Robin: *The Non-Designers' Design Book*, Peachpit Press, 1994
- Zelazny, Gene: *Say It With Charts* Fourth Edition McGraw-Hill, 2000

Articles

- Ainsworth, S.E & Loizou, A. "The effects of self-explaining when learning with text or diagrams" *Cognitive Science*, 27, p 669-681 (2003)
- Hollands, J. & Spence, I. "The discrimination of graphical elements." *Applied Cognitive Psychology*, 15, p 413-431. (2001)

Websites

- <http://www.edwardtufte.com> Information and updates on the work of Professor Edward Tufte.
- <http://www.dartmouth.edu/~chance/> Chance is a quantitative literacy course from universities in the USA.

Glossary

advance organiser	an illustration that introduces a subject to readers by visually ordering component parts of the whole. Used at the beginning of a report (or a section) to visually structure information.
chart	in this guide, chart refers to conceptual charts (organisational charts, flow charts and advanced organisers) and information graphics (maps, diagrams, text tables, photographs, website captures and forms). It is distinct from graphs.
conceptual charts	a collective term for charts that illustrate abstract concepts. For instance, flow charts, advanced organisers and organisational charts
data graphic	a graphic representation based on numerical information; the message is always some comparison of measurement.
demonstration table	a numerical table that provides selected data to emphasise a particular message or idea. Usually short and to the point.
diagram	a sketch showing the structure, framework or parts of an item or thing.
discovery stage	the research and examination of information, especially analysis of data; the discovery stage precedes the presentation stage; during discovery, the meaning and importance of the information is determined.
flow chart	diagrams showing how a process, system, function, etc. is organised or "flows", usually sequentially or cyclically.
graph	in this guide, graph refers to numerical graphics; that is, bar, line and pie charts, histograms, scattergrams and other displays of numeric information.
information graphics	a collective term for visual representations whose purpose is conveying information, rather than communicating aesthetic, emotional or other values; information graphics including numerical and text tables, graphs, maps, diagrams, photographs, and other illustrations.
information visuals	an alternative term for information graphics.
organisational charts	text diagrams that show how individuals, functions, equipment, operations, etc. are arranged; usually based on hierarchy.
orientation chart	another term for advance organiser.
presentation stage	the preparation and delivery of information for an audience; the presentation stage follows the discovery stage; for presentation, the graphic must have a clear purpose and be accurate, vivid, and memorable; its title or sub-title will summarise its purpose.
process chart	another term for flow chart.
reference tables	numerical tables that provide precise and comprehensive information, such as the stock market listings, standard mortality rates, etc.
table	a numerical table lists figures in rows and columns in order to summarise, supplement, and clarify a message.
text box	chunks of text separated from the main document and often enclosed in a box; textboxes focus on a particular concept or explanation. Frequently case studies and examples are put into text boxes.

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