

11

Visualisation Literacy

This final chapter explores some of the important ingredients and tactics that will help you continue to develop and refine your data visualisation literacy. By definition, literacy is the ability to read and write. Applied to data visualisation, this means possessing the literacy both to create visualisations (write) and consume them (read).

Data visualisation literacy is increasingly an essential capability regardless of the domain in which we work and the nature of our technical skills. Just as computer literacy is now a capability that is expected of everyone, one can imagine a time in the not-too-distant future when having data visualisation capabilities will be viewed as a similarly ‘assumed’ attribute across many different roles.

In exploring the components of visualisation literacy across this chapter we will look at two sides of the same coin: the competencies that make up the all-round talents of a visualiser but, first, the tactics and considerations required to be an effective and efficient viewer of data visualisation.

11.1 Viewing: Learning to See

Learning how to understand a data visualisation, as a viewer, is not a topic that has been much discussed in the field until recently. For many the idea that there are possible tactics and efficient ways to approach this activity is rarely likely to have crossed their mind. We just *look* at charts and *read* them, don't we? What else is there to consider?

Many of the ideas for this section emerged from the Seeing Data visualisation literacy research project (seeingdata.org) on which I collaborated.

The fact is we are all viewers. Even if you never create a visualisation again you will always be a viewer and you will be widely exposed to different visual forms of data and information across your daily life. You cannot escape them. Therefore, it seems logical that optimising visualisation literacy as a consumer is a competency worth developing.

Let's put this into some sort of context. As children we develop the ability to read numbers and words. These are only understandable because we are taught how to recognise the association between numeric digits and their representation as numbers and the connection between alphabetical characters with letters and words. From there we begin to understand sentences and

eventually, as we build up a broader vocabulary, we acquire the literacy of language. This is all a big effort. We are not born knowing a language but we are born with the capacity to learn one. Beyond written language, something as simple and singular as, for example, the Wi-Fi symbol is now a universally recognised form of visual language but one that only exists in contemporary culture. For millions of people today, this symbol is a signal of relief and tangible celebration – ‘Thank God, Wi-Fi is available here!’ The context of the use of this symbol would have meant nothing to people in the 1990s: it is a symbol of its time and we have learnt to recognise its use and understand its meaning.

Across all aspects of our lives, there are things that once seemed complicated and inaccessible but are now embedded within us as automatic competencies: driving a car, using a keyboard, cooking a meal. I often think back to growing up as a kid in the 1980s and my first (functioning) computer, the mighty Commodore 64 (C64). One of the most famous games in the UK from this period was *Daley Thompson's Decathlon*. Of particular nostalgic fame was the brutally simple operation of maniacally waggling the single joystick arm left and right to control the running events (if memory serves me correctly, the single button came into use when there were hurdles to jump over).

Consider the universally and immediately understandable control configuration of that game with the frankly ludicrous number of options and combinations that exist on the modern football games, such as the FIFA series on contemporary consoles like the Xbox or PS4. The control combinations required to master the array of attacking moves alone require an entire page of instruction and remarkable levels of finger dexterity. Yet young kids today are almost immediate masters of this game. I should know – I have been beaten by some awfully young opponents. It hurts. But they have simply utilised their capacity to learn through reading and repeated practice.

As discussed in Chapter 1 when looking at the principle of ‘accessible’ design, many data visualisations *will* be intended – and designed – for relatively quick consumption. These might be simple to understand and offer immediately clear messages for viewers to easily comprehend. They are the equivalent of the C64 joystick controls. However, there will be occasions when

you as a viewer are required to invest a bit more time and effort to work through a visualisation that might be based on subject matter or analysis of a more complex nature, perhaps involving many angles of analysis or numerous rich features of interactivity. This is the equivalent prospect of mastering the Xbox controls. Without having the confidence or capability to extract as *much* understanding from the viewing experience as possible and doing so as *efficiently* as possible, you are potentially missing out.

‘Though I consider myself a savvy consumer of bar charts, line graphs, and other traditional styles of data display, I’m totally at sea when trying to grasp what’s going on in, say, arc diagrams, circular hierarchy graphs, hyperbolic tree charts, or any of the seemingly outlandish visualisations ... I haven’t thought much about this flip side, except that I do find I now view other people’s visualisations with a more critical eye.’ **Marcia Gray, Graphic Designer**

As viewers, we therefore need to acknowledge that there might be a need to learn and a reward from learning. We should not expect every type of visualisation to signpost every pearl of

insight that is relevant to us. We might have to work for it. And we have to work for it because we are not born with the ability or the right to understand everything that is presented to us. Few of us will have ever been taught how to go about effectively consuming charts and graphics. We might be given some guidance on how to read charts and histograms, maybe even a scatter plot, if we study maths or the sciences at school. Otherwise, we get by.

But 'getting by' is not really good enough, is it? Even if, through exposure and repetition, we hope gradually to become more familiar with the most common approaches to visualising data, this does not sufficiently equip us with the breadth and range of literacy that will be required.

I mentioned earlier the concept, proposed by Daniel Kahneman, of System 1 and System 2 thinking. The distinctions of these modes of thought manifest themselves again here. Remember how System 1 was intuitive and rapid whereas System 2 was slow, deliberate and almost consciously undertaken? For example, you are acutely aware of thinking when trying to run a mathematical calculation through your mind. That is System 2 at work. In part, due to the almost hyperactive and instinctive characteristics of System 1, when there is a need for System 2 thinking to kick into action, we might try to avoid whatever that activity entails. We get lazy and resort to shortcut solutions or decisions based on intuition. System 1 almost persuades System 2 to sit back and let it look after things. Anything to avoid having to expend effort thinking deeply and rationally.

The demands of learning anything new or hard can trigger that kind of response. It is understandable that somebody facing a complex or unfamiliar visualisation that needs learning might demonstrate antipathy towards the effort required to learn.

Of course, there are other factors involved in learning, such as having the time, receiving assistance or tuition, and recognising the incentive. These are all enablers and therefore their absence can create obstacles to learning. Without assistance from the visualiser, viewers are left to fend for themselves. The role of this book has primarily been to try to raise the standard of the design choices that visualisers make when creating visualisations. Visualisers do not want to obstruct viewers from being able to read, interpret and comprehend. If work is riddled with design errors and misjudgements then viewers are naturally going to be disadvantaged.

However, even with a technically perfect design, as I explained in the definition section of the first chapter, we as visualisers can only do so much to control this experience. There are things we can do to make our work as accessible as possible, but there is also a partial expectation of the viewer to be willing to make some effort (so long as it is 'proportional') to get the most out of the experience. The key point, however, is that this effort should be rewarded.

Many of the visualisations that you will have seen in this book, particularly in Chapter 6, may have been unfamiliar and new to you. They need learning. Your confidence in being able to read different types of charts is something that will develop through practice and exposure. It will be slow and deliberate at first, probably a little consciously painful, but then, over time, as the familiarity increases and the experiential benefits kick in, perceiving these different types of representations will become quite effortless and automatic. System 2 thinking will then transform into a reliably quick form of System 1 thinking.

Over the next few pages I will present a breakdown of the components of effectively working with a visualisation from the perspective of being a viewer. This demonstration will provide you with a strategy for approaching any visualisation with the best chance of understanding *how* to read it and ensure you gain the benefit of understanding from being *able* to read it.

To start with I will outline the instinctive thoughts and judgements you will need to make *before you begin* working with a visualisation. I will then separate the different features of a visualisation, first by considering the common components that sit *outside the chart* and then some pointers for how to go about perceiving what is presented *inside the chart*. This part will also connect with the content included in the chart type gallery found in Chapter 6 describing how to read each unique chart type. Finally, I will touch on the attributes that will lead you, in the longer term, to becoming a *more sophisticated* viewer.

It is important to note that not all data visualisation and infographic designs will have *all* the design features and apparatus items that I describe over the next few sections. There may be good reasons for this in each case, depending on the context. However, if you find there are significant gaps in the work you are consuming, or features of assistance have been deployed without real care or quality, that would point to flawed design. In these cases the viewer is not really being given all the assistance required: the visualiser has failed to facilitate understanding.

Figure 11.1
The Pursuit of Faster

THE PURSUIT OF FASTER

Visualising the evolution of Olympic speed



To mark the London 2012 Olympic Games, the Pursuit of Faster data visualisation project explores the evolution of male and female medal winning performances across all Olympic Games since 1896. It highlights the patterns of improvements in the results of time-based events where speed is the measure of success, whether it be on foot, in water or on water. By choosing a sport and then selecting an event you can see how Gold, Silver and Bronze winning times have changed over the years, for both men and women, as they strive for that ultimate pursuit of being faster than the rest. [Read more about this project.](#)



To illustrate this process I will refer to a case-study project titled 'The Pursuit of Faster: Visualising the Evolution of Olympic Speed'. As the title suggests, the focus of this work was to explore how results have changed (improved or declined) over the years of the Olympics for those events where speed (as measured by a finishing time) was the determinant of success.

Before You Begin

Here are some of the instinctive, immediate thoughts that will cross your mind as soon as you come face to face with a data visualisation. Once again, these are consistent with the impulsive nature of the System 1 thoughts mentioned earlier.

Setting: Think about whether the setting you are in is conducive to consuming a visualisation at that moment in time. Are you under any pressure of time? Are you on a bumpy train trying to read this on your smartphone?

Visual appeal? In this early period of engaging with the work you will be making a number of rapid judgements to determine whether you are 'on board'. One of the ingredients of this is to consider whether the look and feel (the 'form') of the visualisation attract you and motivate you to want to spend time with it.

Relevance? In addition to the visual appeal, the second powerful instinct is to judge whether the subject matter interests you. You might have decided you are on board with your instinctive reaction to the visuals but the key hurdle is whether it is even interesting or relevant to you. Ask yourself if this visualisation is going to deliver some form of useful understanding that confirms, enlightens or thrills you about the topic.

If you respond positively to both those considerations you will likely be intent on continuing to work with the visualisation. Even if you are just positive about one of these factors (form or subject) you will most probably persevere despite the indifference towards the other. If your thoughts are leaning towards a lack of interest in both the relevance of this work and its visual appeal then, depending on circumstances, your tolerance may not be high enough to continue and it will be better to abandon the task there and then.

Initial scan? It is inevitable that your eyes will be instinctively drawn to certain prominent features. This might be the title or even the chart itself. You may be drawn to a strikingly large bar or a sudden upward rise on a line chart. You might see a headline caption that captures your attention or maybe some striking photo imagery. It is hard to fight our natural instincts, so don't. Allow yourself a brief glance at the things you feel compelled to look at – these are likely the same things the visualiser is probably hoping you are drawn to. Quickly scanning the whole piece, just for an initial period of time, gives you a sense of orientation about what is in store.

In 'The Pursuit of Faster' project you might find yourself only drawn to this if you have a passing interest in the Olympics and/or the history of athletic achievement. On the surface, the visuals might look quite analytical in nature, which might turn some people off. The initial scan probably focuses on elements like the Olympic rings and the upward direction of the lines in the chart which might offer a degree of intrigue, as might the apparent range of interactive controls.

Outside the Chart

Before getting into the nuts and bolts of understanding the chart displays, you will first need to seek assistance from the project at large to understand in more detail what you are about to take on and how you might need to go about working with it.

The Proposition

Considering the proposition offered by the visualisation is about determining how big a task of consuming and possibly interacting you have ahead of you. What is its shape, size and nature?

Format: Is it presented in a print, physical or digital format and what does this make you feel about your potential appetite and the level of your engagement? Is it static or interactive and what does this present in terms of task?

- If it is a static graphic, how large and varied is the content – is it a dense display with lots of charts and text, or quite a small and compact one? Does the sequence of content appear logical?
- If it is interactive, how much potential interactivity does there appear to be – are there many buttons, menus, options, etc.? Where do the interactive events take you? Are there multiple tabs, pages or layers beneath this initial page? Have a click around.

Shape and size: Do you think you will probably have to put in a lot of work just to scan the surface insights? Is there a clear hierarchy or sequence derived through the size and position of elements on the page? Does it feel like there is too much or too little content-wise? If the project layout exceeds the dimensions of your screen display, how much more scrolling or how many different pages will you have to look through to see the whole?

This initial thinking helps you establish how much work and effort you are going to be faced with to explore the visualisation thoroughly. In ‘The Pursuit of Faster’ project, it does not feel like there is too *much* content and all the possible analysis seems to be located within the boundaries of the immediate screen area. However, with a number of different selectable tabs, interactive options and collapsible content areas lurking beneath the surface, it could be more involving than it first appears.

What’s this Project About?

Although you have already determined the potential relevance of this subject matter (or otherwise) you will now look to gain a little more insight into what the visualisation is specifically about.

Title: You will have probably already glanced at the title but now have another look at it to see if you can learn more about the subject matter, the specific angle of enquiry or perhaps a headline finding. In the sample project (Figures 11.2 and 11.3), the presence of the Olympic rings logo on the right provides an immediate visual cue about the subject matter, as you might have observed in the initial scan. The title, ‘The Pursuit of Faster’, is quite ambiguous, but as the supporting subtitle reveals, ‘Visualising the evolution of Olympic speed’ helps to explain what the visualisation is about.



Figure 11.2 Excerpt from 'The Pursuit of Faster'

Source: If it is a web-based visualisation the URL is worth considering. You might already know where you are on the Web, but if not you can derive plenty from the site on which this project is being hosted. An initial sense about trust in the data, the author and the possible credibility of insights can be drawn from this single bit of information. This particular project is hosted on my website, visualisingdata.com, and so may not carry the same immediate recognition that an established Olympics or sport-related site might command. There is nothing provided in the main view of the visualisation that informs the viewer who created the project. Normally this might have been detailed towards the bottom of the display or underneath the title, but in this case viewers have to click on a 'Read more...' link to find this out. If there are no details provided about the author/visualiser, as a viewer, this anonymity might have any affect on your trust in the work's motives and quality.

Introduction: While some visualisation projects will be relatively self-explanatory, depending on the familiarity of the audience with the subject matter, others will need to provide a little extra guidance. The inclusion of introductory text will often help 'set the scene', providing some further background about the project. If, as the viewer, the introduction fails to equip you with all the information you feel you need about the visualisation, then the visualiser has neglected to include all the assistance that might be necessary.

In 'The Pursuit of Faster' project, the introductory text provides sufficient initial information about the background of the project based on a curiosity about what improvements in speed have been seen throughout the history of the Olympics. As mentioned, there is a 'Read more...'

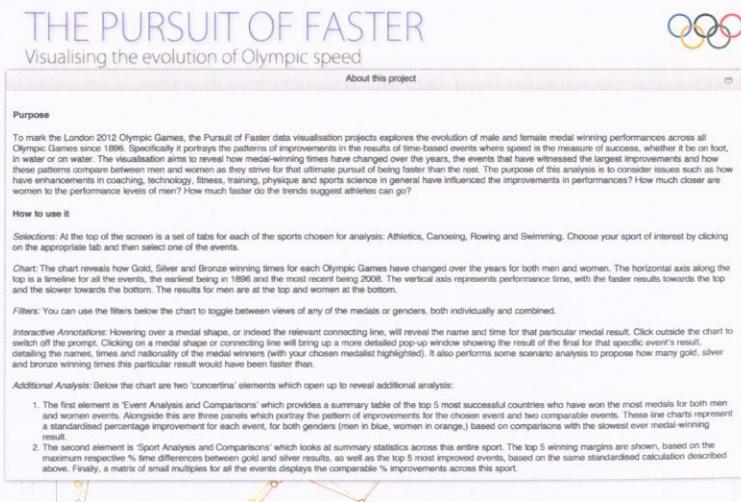


Figure 11.3 Excerpt from 'The Pursuit of Faster'

link to find more information that was perhaps too much to include in the main opening paragraph. This includes a comprehensive 'How to use it' guide providing a detailed account about the content and role of each section of the project, including advice on how to read the chart and utilise the interactive features.

What Data?

Any visualisation of data should include clear information to explain the origin of the data and what has been done with it in preparation for its visual portrayal.

Data source: Typically, details of the data source will be located in the introduction, as a footnote beneath a chart or at the bottom of a page. It is important to demonstrate transparency and give credit to the origin of your data. If none is provided, that lowers trust.

Data handling: It is also important to explain how the data was gathered and what, if any, criteria were applied to include or exclude certain aspects of the subject matter. These might also mention certain assumptions, calculations or transformations that have been undertaken on the data and are important for the reader to appreciate.

In 'The Pursuit of Faster' project, the link you saw earlier to 'Read more ...' provides details about the origin of the data and the fact that it only includes medal winners from summer Olympic events that have a time-based measure.

What Interactive Functions Exist?

As you have seen in Chapter 8, interactive visualisations (typically hosted on the Web or in an app) aim to provide users with a range of features to interrogate and customise the presentation of the data.

Sometimes, interactive features are enabled but not visible on the surface of a project. This might be because visualisers feel that users will be experienced enough to expect certain interactive capabilities without having to make these overly conspicuous by labelling or signposting their presence. For example, rather than show all the value labels on a bar chart you might be able to move the mouse over a bar of choice and a pop-up will reveal the value. The project might not tell you that you can do this, but you may intuitively expect to. Always fully explore the display with the mouse or through touch in order to gain a sense of all the different visible and possibly invisible ways you can interact with the visualisation.

In 'The Pursuit of Faster' project (Figure 11.4), you will see multiple tabs at the top, one for each of the four sports being analysed. Clicking on each one opens up a new set of sub-tabs beneath for each specific event within the chosen sport.

Figure 11.4

Excerpt from
'The Pursuit of
Faster'

Athletics	Canoeing	Rowing	Swimming
100m	100m Hurdles	110m Hurdles	200m
10000m	20km Walk	50km Walk	Marathon

Choosing an event will present the results in the main chart area (Figure 11.5). Once a chart has loaded up, you can then filter for male/female and also for each of the medals using the buttons immediately below the chart. Within the chart, hovering above a marker on the chart will reveal the specific time value for that result. Clicking on the marker will show the full race results and offer further analysis comparing those results with the all-time results for context.

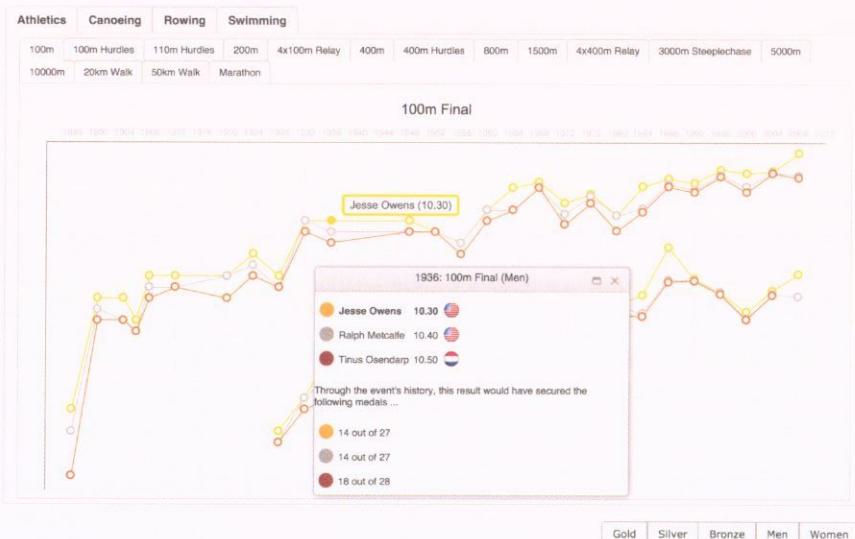


Figure 11.5
Excerpt from 'The Pursuit of Faster'

Finally, the collapsible menus below the chart show further detailed analysis and comparisons within and between each sporting event (Figure 11.6). The location of this implies that it is of lower relative importance than the chart or maybe is a more detailed view of the data.



Figure 11.6
Excerpt from 'The Pursuit of Faster'

Inside the Chart

Now you have acquainted yourself with the key features of a visualisation outside the chart, the next stage is to start the process of deriving understanding from the chart.

The process of consuming a chart varies considerably between different chart types: the approach to drawing observations from a chart showing trends over time is very different from how you might explore a map-based visualisation. The charts I profiled in Chapter 6 were each accompanied by detailed information on the type of observations you should be looking to extract in each case.

In Chapter 1 you learnt how there were three elements involved in the achievement of understanding a chart: *perceiving*, *interpreting* and *comprehending*. Let's work through these steps by looking at the analysis shown for the 100m Finals.

Perceiving: The first task in perceiving a chart is to establish your understanding about the role of every aspect of the display. Here we have a line chart (Figure 11.7) which shows how quantitative values for categories have changed over time. This chart is structured around a horizontal x-axis showing equal intervals from the earliest Olympics (1896) on the left through to the most recent (2012) on the right, although the latest values in the data only seem to reach 2008. Depending on your interest in this topic, the absence of data for the more recent Olympics may undermine your sense of its completeness and representativeness.

Figure 11.7

Excerpt from 'The Pursuit of Faster'



The vertical y-axis is different from what you might normally see for two reasons. Firstly, it moves downwards below the x-axis (rather than upwards, as is more common), and secondly, there is no labelling, either of the variable plotted or of scale values.

I can see that the encoding is formed by points (marking the race results) and connecting lines showing the change over time. Through the use of colour there are plotted lines for the gold, silver and bronze medal winning times for each Olympics. There are two sets of medal lines but there is no obvious distinction to explain what these are. With no direct labelling of the values I hover over the point ('medal') markers and a tooltip annotation comes up with the athlete's name and time in a medal-coloured box. I compare tooltip info for the lines at the top and

those below and discover the lower lines are the women's results and the upper lines are the men's results.

From the tooltip info I can determine that the quicker times (the gold medal line) are at the top so this suggests that the y-axis scale is inverted with quicker (smaller) times at the top and slower (larger) times at the bottom. This also reveals that there is no origin of zero in the vertical axis; rather the quickest time is anchored just below the top of the chart, the slowest stretches down to the bottom of the chart, and then all the values in between are distributed proportionally.

Inside the chart I now try clicking on the markers and this brings up details about the event (for that gender), including the three medal winners, their times and small flags for the countries they represented. I can also read an interesting statistic that explains if the time for the medallist I selected had been achieved throughout the event's history, it would have secured gold, silver or bronze medals on x number of occasions.

I now know enough about the chart's structure and encodings to be able to start the process of perceiving the patterns to make some observations about what the data is showing me:

- I can see that there is a general rise across all Olympics for the event in both men's and women's results.
- It feels like the women's times are getting closer to the men's, with Florence Griffith Joyner's victory time in 1988 being the closest that the respective times have been – her result there would have been good enough for a men's bronze in 1956.
- There are no real patterns between medal times; they are neither always more packed closely together, nor always spread out – it changes on each occasion.
- I notice the gaps where there were no events, during the First and Second World Wars, and also the presence of an obscure 1906 event, the only Olympic Games that did not follow the four-year interval.

Interjecting as the visualiser responsible for this project, let me explain that the focus was on patterns of relative change over time, not necessarily absolute result times. As every different event has a different distance and duration behind the final timed results, a common scale for all results needed to be established, which is why this decision was taken to standardise all results and plot them across the vertical chart space provided.

Interpreting: As someone who follows a lot of sport and, like most people, is particularly familiar with the 100m event, I feel there is a lot of information I can get out of this display at both a general level, looking at the relative patterns of change, and a local level, checking up on individual medallists and their absolute values. Thinking about what these patterns mean, on looking at the times from the first Olympic Games in 1896 until the 1960s there was a lot of improvement and yet, since the 1960s, there is generally a much flatter shape – with only a gradual improvement in the times for both genders. This tells me that maybe the threshold for the capacity of athletes to run faster is getting closer. Even with all the contributions of sports science over the past few generations, the increase in speed is only ever marginal. That was until Usain Bolt blew the world away in 2008 and, likewise for women, Shelly-Ann Fraser improved the women's results for the first time in 20 years.

Comprehending: What does this all mean to me? Well it is interesting and informative and, while I have no direct investment in this information in terms of needing to make decisions or it triggering any sense of emotion in me, in outcome terms I feel I have learnt more about a topic through this chart than I would have done just looking at the data. My understanding of the history of the Olympic 100m final has been expanded and, in turn, I have a better appreciation of the advancements in speed across and between both genders.

Becoming a More Sophisticated Consumer

Effective visualisation requires the visualiser and viewer to operate in harmony, otherwise the possibility of facilitating understanding is compromised. Beyond the mechanics of perceiving a visualisation, there are softer ‘attitudinal’ differences you can make to give yourself even more of a chance of gaining understanding. This is about modifying your mindset to be more critically appreciative of the challenges faced by the visualiser responsible for producing the work as well as its intended purpose. It is about showing empathy in your critical evaluation which will markedly help you become an increasingly sophisticated consumer.

Appreciation of context: When consuming a visualisation try to imagine some of the circumstances and constraints that might have influenced the visualiser’s decisions:

- You might not find the subject matter interesting, but other people might. You have the right not to read or interact with a visualisation that has no relevance to you. If it *should* have relevance, then that’s when there may be some problems!
- If you are struggling to understand a visualisation it could be that the project was aimed more at specialists, people with specific domain knowledge. Your struggles are possibly not a reflection of an ineffective visualisation or any deficit in your expected knowledge – it just was not intended for you.
- If the size of the text is frustratingly tiny on your screen, maybe it was intended primarily for printing as a poster and would have been the right size if consumed in its native format?
- When criticising a work, spare a thought for what could have been done differently. How would you imagine an alternative way to represent the data? What other design solutions would you have tried? Sometimes what is created is a reflection of crippling constraints and might more closely resemble the least-worst solution than the best.

Overview first, details if provided: Sometimes a visualiser only aims to offer a sense of the big picture – the big values, the medium and the small ones. Just because we cannot instantly read precise values from a chart it is important to avoid getting frustrated. Our default state as viewers is often to want every detail available. Sometimes, we just need to accept the idea that a gist of the hierarchy of values is of more worth than the precise decimal point precision of specific values. It may be that it was not feasible to use a chart that would deliver such detailed reading of the data – many charts simply cannot fulfil this. We might not even realise that we are just a mouseover or click away from bringing up the details we desire.

False consciousness: Do you *really* like the things you like? Sometimes we can be too quick to offer a ‘wow’ or a ‘how cool is that?’ summary judgement before even consuming

the visualisation properly. It is quite natural to be charmed by a superficial surface appeal (occasionally, dare I say it, following the crowd?). Ask yourself if it is the subject, the design or the data you like? Could *any* portrayal of that compelling data have arrived at an equally compelling presentation of that content?

Curiosities answered, curiosities not answered: Just because the curiosity you had about a subject is not answerable does not make the visualisation a bad one. Statements like 'This is great but I wish they'd shown it by year ...' are valid because they express your own curiosity, to which you are entirely entitled. However, a visualiser can only serve up responses to a limited number of different angles of analysis in one project. The things you wanted to know about, which might be missing, may simply have not been possible to include or were deemed less interesting than the information provided. If you are thinking 'this would have been better on a map', maybe there was no access to spatial data? Or maybe the geographical details were too vague or inaccurate to generate sufficient confidence to use them?

11.2 Creating: The Capabilities of the Visualiser

Now that you are reaching the end of this journey, it will be quite evident that data visualisation design is truly multidisciplinary. It is the variety that fuels the richness of the subject and makes it a particularly compelling challenge. To prepare you for your ongoing development, the second part of this final chapter aims to help you reflect on the repertoire of skills, knowledge and mindsets required to achieve excellence in data visualisation design.

The Seven Hats of Data Visualisation

Inspired by Edward de Bono's *Six Thinking Hats*, the 'Seven hats of data visualisation' is a breakdown of the different capabilities that make up the multi-talented visualiser. The attributes listed under each of these hats can be viewed as a wish-list of personal or team capabilities, depending on the context of your data visualisation work.

Project Manager

The **coordinator** – oversees the project

Initiates and leads on formulating the brief

Identifies and establishes definitions of key circumstances

Organises the resources according to the ambition of a project

Manages progress of the workflow and keeps it cohesive

Has a 'thick skin', patience and empathy

Gets things done: checks, tests, finishes tasks

Pays strong attention to detail

Communicator

- The **broker** – manages the people relationships
 Helps to gather and understand requirements
 Manages expectations and presents possibilities
 Helps to define the perspective of the audience
 Is a good listener with a willingness to learn from domain experts
 Is a confident communicator with laypeople and non-specialists
 Possesses strong copy-editing abilities
 Launches and promotes the final solution

Scientist

- The **thinker** – provides scientific rigour
 Brings a strong research mindset to the process
 Understands the science of visual perception
 Understands visualisation, statistical and data ethics
 Understands the influence of human factors
 Verifies and validates the integrity of all data and design decisions
 Demonstrates a *system's thinking* approach to problem solving
 Undertakes reflective evaluation and critique

Data Analyst

- The **wrangler** – handles all data work
 Has strong data and statistical literacy
 Has the technical skills to acquire data from multiple sources
 Examines the physical properties of the data
 Undertakes initial descriptive analysis
 Transforms and prepares the data for its purpose
 Undertakes exploratory data analysis
 Has database and data modelling experience

Journalist

- The **reporter** – pursues the scent of an enquiry
 Defines the trigger curiosity and purpose of the project
 Has an instinct to research, learn and discover
 Driven by a desire to help others understand

Possesses or is able to acquire salient domain knowledge
 Understands the essence of the subject's data
 Has empathy for the interests and needs of an audience
 Defines the editorial angle, framing and focus

Designer

The **conceiver** – provides creative direction
 Establishes the initial creative pathway through the purpose map
 Forms the initial mental visualisation: ideas and inspiration
 Has strong creative, graphic and illustration skills
 Understands the principles of user interface design
 Is fluent with the full array of possible design options
 Unifies the decision-making across the design anatomy
 Has a relentless creative drive to keep innovating

Technologist

The **developer** – constructs the solution
 Possesses a repertoire of software and programming capabilities
 Has an appetite to acquire new technical solutions
 Possesses strong mathematical knowledge
 Can automate otherwise manually intensive processes
 Has the discipline to avoid feature creep
 Works on the prototyping and development of the solution
 Undertakes pre- and post-launch testing, evaluation and support

Assessing and Developing Your Capabilities

Data visualisation is not necessarily a hard subject to master, but there are plenty of technical and complicated matters to handle. A trained or natural talent in areas like graphic design, computer science, journalism and data analysis is advantageous, but very few people have all these hats. Those that do cannot be exceptional at everything listed, but may be sufficiently competent at most things and then brilliant at some. Developing mastery across the full collection of attributes is probably unachievable, but it offers a framework for guiding an assessment of your current abilities and a roadmap for the development of any current shortcomings.

'Invariably, people who are new to visualisation want to know where to begin, and, frankly, it's understandably overwhelming. There is so much powerful work now being done at such a high level of quality, that it can be quite intimidating! But you have to start somewhere, and I don't think it matters where you start. In fact, it's best to start wherever you are now. Start from your own experience, and move forward. One reason I love this field is that everyone comes from a different background – I get to meet architects, designers, artists, coders, statisticians, journalists, data scientists ... Data vis is an inherently interdisciplinary practice: that's an opportunity to learn something about everything! The people who are most successful in this field are curious and motivated. Don't worry if you feel you don't have skills yet; just start from where you are, share your work, and engage with others.' **Scott Murray, Designer**

being aware of the options and the mechanics behind making choices – arguably has a greater influence on effective work. Thereafter, the journey from *good* to *great*, as with anything, involves hard work, plenty of learning, lots of guidance and, most importantly, relentless practice.

The Value of the Team

The idea of team work is important. There are advantages to pursuing data visualisation solutions collaboratively, bringing together different abilities and perspectives to a shared challenge. In workplaces across industries and sectors, as the field matures and becomes more embedded, I would expect to see a greater shift towards recognising the need for interdisciplinary teams to fulfil data visualisation projects collectively.

The best functioning visualisation team will offer a collective blend of skills across all these hats, substantiating some inevitably, but also, critically, avoiding skewing the sensibilities towards one dominant talent. Success will be hard to achieve if a team comprises a dominance in technologists or a concentration of 'ideas' people whose work never progresses past the sketchbook. You need the right blend in any team.

We have seen quite a lot of great examples of visualisation and infographic work from newspaper and media organisations. In the larger organisations that have the fortune of (relatively) large graphics departments, team working is an essential ingredient behind much of the success they have had. Producing relentlessly high-quality, innovative and multiple projects in parallel, within the demands of the news environment, is no mean feat. Such organisations might have

I am painfully aware of the things I am simply not good enough at (programming), the things I have no direct education in (graphic design) and the things I do not enjoy (finishing, proofreading, note-taking). Compromise is required with the things you do not like – there are always going to be unattractive tasks, so just bite the bullet and get on with them. Otherwise, you must seek either to address your skills gap through learning and/or intensive practice, finding support from elsewhere through collaboration, or to simply limit your ambitions based on what you *can* do.

Regardless of their background or previous experience, everyone has something to contribute to data visualisation. Talent is important, of course, but better *thinking* is, in my view, the essential foundation to focus on first. Mastering the demands of a systems' thinking approach to data visualisation –

the most people and also some of the best people, but their output is still representative of their punching above their weight, no matter how considerable that base.

Developing Through Evaluating

There are two components in evaluating the outcome of a visualisation solution that will help refine your capabilities: what was the *outcome* of the work and how do you reflect on *your performance*?

Outcome: Measuring effectiveness in data visualisation remains an elusive task – in many ways it is the field's 'Everest' – largely because it must be defined according to local, contextual measures of success. This is why establishing an early view of the intended 'purpose', and then refining it if circumstances change, was necessary to guide your thinking throughout this workflow.

Sometimes effectiveness is tangible, but most times it is entirely intangible. If the purpose of the work is to further the debate about a subject, to establish one's reputation or voice of authority, then those are hard things to pin down in terms of a yes/no outcome. One option may be to flip the measure of effectiveness on its head and seek out evidence of tangible ineffectiveness. For example, there may be significant reputation-based impacts should decisions be made on inaccurate, misleading or inaccessible visual information.

There are, of course, some relatively free quantitative measures that are available for digital projects, including web-based measures such as visitor counts and social media metrics (likes, retweets, mentions). These, at least, provide a surface indicator of success in terms of the project's apparent appeal and spread. Ideally, however, you should aspire also to collect more reliable qualitative and value-added feedback, even if this can, at times, be rather expensive to secure. Some options include:

- capturing anecdotal evidence from comments submitted on a site, opinions attributed to tweets or other social media descriptors, feedback shared in emails or in person;
- informal feedback through polls or short surveys;
- formal case studies which might offer more structured interviews and observations about documented effects;
- experiments with controlled tasks/conditions and tracked performance measures.

Your performance: A personal reflection or assessment of your contribution to a project is important for your own development. The best way to learn is by considering the things you enjoyed and/or did well (and doing more of those things) and identifying the things you did not enjoy/do well (and doing less of those things or doing them better). So look back over your project experience and consider the following:

- Were you satisfied with your solution? If yes, why; if no, why and what would you do differently?
- In a different context, what other design solutions might you have considered?

- Were there any skill or knowledge shortcomings that restricted your process and/or solution?
- Are there aspects of this project that you might seek to recycle or reproduce in other projects? For instance, ideas that did not make the final cut but could be given new life in other challenges?
- How well did you utilise your time? Were there any activities on which you feel you spent too much time?

'There is not one project I have been involved in that I would execute exactly the same way second time around. I could conceivably pick any of them – and probably the thing they could all benefit most from? More inter-disciplinary expertise.' Alan Smith OBE, Data Visualisation Editor, *Financial Times*

Developing effectiveness and efficiency in your data visualisation work will take time and will require your ongoing efforts to learn, apply, reflect and repeat again. I am still learning new things every day. It is a journey that never stops because data visualisation is a subject that has no ending.

However, to try offer a suitable conclusion to this book, at least, I will leave you with this wonderful bit of transcribed from a video of Ira Glass, host and producer of 'This American Life'.

Nobody tells this to people who are beginners, I really wish someone had told this to me. All of us who do creative work, we get into it because we have good taste... [but] there is this gap and for the first couple of years that you're making stuff, what you're making is just not that good... It's trying to be good, it has potential, but it's not. But your taste, the thing that got you into the game, is still killer. And your taste is why your work disappoints you. A lot of people never get past this phase, they quit. Most people I know who do interesting, creative work went through years of this. We know our work doesn't have this special thing that we want it to have. We all go through this. And if you are just starting out or you are still in this phase, you gotta know it's normal and the most important thing you can do is do a lot of work. Put yourself on a deadline so that every week you will finish one story. It is only by going through a volume of work that you will close that gap, and your work will be as good as your ambitions. And I took longer to figure out how to do this than anyone I've ever met. It's gonna take awhile. It's normal to take awhile. You've just gotta fight your way through.

Summary: Visualisation Literacy

Viewing: Learning to See

Before You Begin

- Setting: is the situation you are in conducive to the task of consuming a visualisation? In a rush? Travelling?
- Visual appeal: are you sufficiently attracted to the appearance of the work?

- Relevance: do you have an interest or a need to engage with this topic?
- Initial scan: quickly orientate yourself around the page or screen, and allow yourself a brief moment to be drawn to certain features.

Outside the Chart

- The proposition: what task awaits? What format, function, shape and size of visualisation have you got to work with?
- What's the project about?: look at the titles, source, and read through any introductory explanations.
- What data?: look for information about where the data has originated from and what might have been done to it.
- What interactive functions exist?: if it is a digital solution browse quickly and acquaint yourself with the range of interactive devices.

Inside the Chart Refer to the Chart Type Gallery in Chapter 6 to learn about the approaches to perceiving and interpreting different chart types.

- Perceiving: what does it show?
- Interpreting: what does it mean?
- Comprehending: what does it mean to me?

Becoming a More Sophisticated Consumer

- Appreciation of context: what circumstances might the visualiser have been faced with that are hidden from you as a viewer?
- Overview first, details if provided: accept that sometimes a project only aims to (or maybe only can) provide a big-picture gist of the data, rather than precise details.
- False consciousness: don't be too quick to determine that you like a visualisation. Challenge yourself, do you *really* like it? Do you *really* gain understanding from it?
- Curiosities answered, curiosities not answered: just because it does not answer your curiosity, it might answer those of plenty of others.

Creating: The Capabilities of the Visualiser

The Seven Hats of Data Visualisation Design

- Project Manager: the coordinator – oversees the project.
- Communicator: the broker – manages the people relationships.
- Scientist: the thinker – provides scientific rigour.
- Data analyst: the wrangler – handles all the data work.
- Journalist: the reporter – pursues the scent of enquiry.
- Designer: the conceiver – provides creative direction.
- Technologist: the developer – constructs the solution.

Assessing and Developing Your Capabilities

The importance of reflective learning: evaluating the outcome of the work you have created and assessing your own performance during its production.

Tips and Tactics

- The life and energy of data visualisation are online: keep on top of blogs, the websites of major practitioners and agencies creating great work. On social media (especially Twitter, Reddit) you will find a very active and open community that is willing to share and help.
- Practise, practise, practise: experience is the key – identify personal projects to explore different techniques and challenges.
- Learn about yourself: take notes, reflect, self-critique, recognise your limits.
- Learn from others: consume case studies and process narratives, evaluate the work of others ('what would I do differently?').
- Expose yourself to the ideas and practices of other related creative and communication fields: writing, video games, graphic design, architecture, cartoonists.

What now? Visit book.visualisingdata.com

READING
Visit the chapter's library of further reading and references to continue developing the dual components of your visualisation literacy

EXERCISES
Undertake these practical exercises to help refine your skill and understanding about data visualisation literacy

CASE STUDY

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These references relate to content mentioned in the body text and/or attributed quotes that do not come from individual interviews with the author. Extensive further reading lists to support each chapter's content are provided in the companion digital resources.

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