The Unwritten Rules of PhD Research

Third Edition

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Preface to the first edition

One of the most frequent laments of the postgraduate researcher is: 'Why didn't someone tell me that earlier?' There are innumerable things which nobody bothered to tell you, or to write in the books, and which could have saved you from large amounts of confusion, depression, wasted effort and general tears and misery if only you had been told them earlier.

The authors have spent more than their fair share of time with desperate beginners, explaining the basic principles of research over cups of coffee. This book is an attempt to cut down their caffeine overload. It explains the basic craft skills and ground rules of the academic world in general, and research in particular. Its focus is the vitally important things that the standard textbooks don't bother to mention on the sweet assumption that they can be left to the readers' lecturers and supervisors.

If you are doing a PhD or an MPhil, then this book is intended to help you to do the best research possible with the minimum of wasted effort. It is also intended to help you use your research as part of your career development and self-development so that you don't end up on graduation day, certificate in hand, wondering just what the hell to do next and realising that you've just spent several years moving painfully in the wrong direction.

The authors' backgrounds are varied. Their academic credentials include PhDs, publication of various journal papers and encyclopaedia articles, advanced research fellowships, a couple of journal editorships, refereeing for major journals and fund-giving bodies, and raising between them over a million pounds of research funding. Their students still talk to them, and sometimes say nice things about them.

What's new in this edition?

In order to reflect developments in academia since the last edition was published, the new edition has been refreshed and updated, and includes:

- A new section on social media. This focuses on the underlying principles and issues, to future-proof it against changes in technologies and platforms, whilst providing enough contemporary examples to reflect the use of social media both within research practice and other aspects of people's lives.
- A new section on literature reviews, including Systematic Literature Reviews (SLRs), in the 'The need to read critically' section in Chapter 6. This section includes a critical description of recent developments in research, in particular the replication crisis, and of their implications for traditional wisdom about literature reviews in general, and SLRs in particular.
- More material on ethics and their implications for research in practice.
- More material on managing the PhD as a project, describing essential skills for managing the many competing activities of the PhD process.

Although some aspects of the research landscape may have changed since the previous edition was published, many of the book's central tenets are as relevant as ever. Therefore, the book retains its key strengths:

- An informal style which aims to give the reader precise, clear, no-nonsense advice about doing a PhD
- A commitment to explaining the reasons behind certain academic practices – for example, why citations are provided and why certain styles are preferable, what a conference is and what it is for, and why academic language has evolved in the way it has
- Coverage of the viva, which is considered to be one of the distinguishing features of this text and one that is often commented upon by students as a 'life-saver'
- The overarching structure and content which carries the student through the creation of the PhD 'master piece' without losing sight of the original motivations for undertaking it in the first place.

Acknowledgements

We would like to thank all the people who helped us with the writing and publishing of this book – they know who they are.

We thank John Oates for permitting us to use his material on ethics. The book draws on material we have been amassing and rehearsing over time in a variety of contexts, and so inevitably parts resemble material presented or published in other contexts. We have done our best to indicate cases where this is so and to seek permission in good faith.

We would also like to acknowledge our gratitude to our own PhD supervisors, from whom we learned much, much more than we realised at the time. Our remaining sins are our own faults, not theirs. Finally, we would like to acknowledge the students who have, directly and indirectly, brought colour to our lives, and wealth to coffee manufacturers round the world . . . without them, this book would never have been written, and our lives would have been much less fun.

Chapter 1

So, what is a PhD?

• How to get the best from this book • What is a PhD? • Cabinet-making – the PhD as a 'master piece' • Cabinet-making skills • Instrumental and expressive behaviour • Necessary skills • Criteria for a PhD: some reassurance

The core concept of the PhD is simple: it's a demonstration that you have the skills to conduct research independently. The process is equally simple in concept: you do a body of research that acts as a showcase for your research knowledge and skills, you write it up, and you then have a critical discussion about it (i.e. a *viva voce* examination) with professional researchers who decide whether you should be awarded a PhD. The concept is simple, but students find it daunting, because it is not specified and structured the way lower degrees are; because it relies on the student bringing intelligence and intellectual discipline to bear in 'the discovery of knowledge', a goal that is open-ended and not easily quantified; and because so much rests on the final assessment. Students often ask: 'How will I know that my work is good enough? That I'm good enough?'

Why do people bother? There are different reasons for undertaking a PhD, ranging from the pragmatic (e.g. acquiring a research credential for academia or for industry) to the idealistic (e.g. aspiring to deep scholarship). Students have many reasons in between, including things like curiosity, a drive to chase a long-held question, an avoidance of abject drudgery or the need to prove oneself. More important still are the reasons for finishing a PhD, the drivers that keep students going when the going gets tough. Students often don't admit those reasons readily, but when they do they're usually personal and potent: doing something your big brother didn't manage, laughing in the face of that disparaging infant school teacher, avoiding conscription, escaping the family business, getting a dreamed-for job. Your reason for finishing is important to your success, and you need a reason compelling enough to take you through the obstacles and frustrations of the process.

This book is written to help students who have read books about doing a PhD, and been on their university's courses, and turned up conscientiously to meetings with their supervisors, but who still feel lost and confused and hopeless. We've seen a lot of good students in that situation. Usually, they haven't hit problems because of themselves or what was in the books or courses or supervision. (Indeed, we recommend that you engage with the opportunities available to you.) Instead, they've hit problems because of what *wasn't* in themselves or in the books, courses or supervision. There are often significant gaps and omissions in how 'the pursuit of knowledge' is conveyed.

That's why this book's title includes the word 'unwritten'. It's about the things which you need to know, but which usually aren't written down anywhere. Most of this book is about the knowledge that the university system assumes that you already have. We also describe ways of getting at the non-verbal skills that can't be translated into words, and finding out about taboo topics. Most of these ways are variants on having an informal cup of coffee with someone wise and supportive, which is why each edition of this book has had a cover illustration showing cups of coffee and repeated references to those informal conversations. The 'I can't put it into words' and the 'won't talk about it' types of knowledge really are that important.

This book is also written to help students who have deeper doubts, which appear as themes such as: 'people like me can't do PhDs' or 'I need to be realistic in my aspirations'. We've seen a lot of students from challenging or atypical backgrounds or with low self-esteem who did brilliantly in PhDs, and achieved things that they didn't believe were possible. This book is written to help students whose lives could be transformed by a supportive nudge at the right moment.

We emphasise that most of the big challenges that face PhD students cut across backgrounds and personalities. International students must understand and adjust to the local culture, yes – but similarly part-time students must adjust to the academic culture. The insights about learning to engage with your specific research community cut across all categories of students, just as the insights about critical thinking, project management, and managing supervisory relationships do, and so we typically don't address specific categories of student, but rather compile what we've learned from all of them.

That's the background to this book. In our experience, PhDs transform people's lives for the better, in ways that they had never believed would be possible for them. That doesn't mean they are easy. The rest of this book is about handling the challenge.

How to get the best from this book

The best way to use this book is as follows:

1 First, skim through it, so you get an overview of the key concepts.
2 Then, re-read it more slowly, starting at the end, and working backward. Working backward makes it much easier to see how to get to your destination,

and to identify the points that are important for you, rather than getting hung up on the problems immediately in front of you and losing sight of the Big Picture. That's also the best way to think about the PhD itself.

3 Finally, use individual chapters from this book when you need them. We've organised the chapters to map onto key points in the PhD journey, and onto key issues that you're likely to encounter.

The key points in the journey are easy to identify, such as the viva. The key issues are usually less easy to identify when you're a student in the middle of a PhD.

They fall into two main categories. One is 'big picture' knowledge about how the academic system works, and why it works that way. For instance, what are some classic career paths in academia? Why is academic writing deliberately dull? Why do some people get lectureships in good departments before they've finished their PhD, whereas others are still struggling to find any job ten years after their doctorate? What counts as a 'good' department, and why? Many students are too embarrassed to show their ignorance by asking questions like these; more students are too focused on the immediate problems of the PhD to think of asking them until it's too late.

The second category involves what are known as 'craft skills'. These are usually hands-on skills, and are normally viewed as not sufficiently important to be worth mentioning in textbooks, and treated as minor details to be taught informally by supervisors or other mentors. These range from quite specific information (e.g. 'How many references should I have in the first paragraph of something I write?') to broader skills (e.g. 'How can I get a reasonable brief overview of this topic that my supervisor's advised me to read about, without spending six months wading through the literature?') The skills, and the answers, and the reasons for them, vary across disciplines; however, once you're aware of the basic concept of craft skills, you can then find out what the craft skills are in your chosen area, and learn them.

So, each chapter of this book deals with an area of knowledge which is important to PhD students. Some, such as how to handle criticism, are relevant in more than one place (for instance, handling criticism is relevant to writing, to presentations and to the viva). Others, such as writing, manifest themselves in different ways at different stages of your PhD (which is why this book is structured around both topics and the chronological process). Each chapter describes and discusses its topic, and is illustrated with examples and anecdotes. Where an anecdote is dubious or apocryphal, we've said so; the others are true, even when improbable. The descriptions are intended to help you understand what the issues are, and why things are the way they are; the anecdotes are there to illustrate the underlying points and to help you remember them.

Many of the chapters end with a table that summarises some useful tips. The tables are offered as additional *aides-mémoire* – guides you can photocopy and stick on your wall; they are not chapter summaries.

An important thing to keep in mind when reading this book is that disciplines vary. This is why we use words such as 'usually'. For example, the

precise indications of quality in a journal paper will be different between, say, history and geology, but the underlying deep-structure concepts usually remain the same – for instance, the concept of a strong paper as opposed to a weak one. This book is intended to help you understand what these underlying concepts are, so that you can find out what form they take in your discipline, and then make sure that you have the right indicators of quality in your written work, in your presentations and in your CV.

On the subject of informality, we have deliberately used an informal style throughout this book – the style we'd use in a conversation over coffee, not the style we'd use in journal articles or dissertations.

We've deliberately omitted a variety of other research-related topics, such as how to use statistics, on the grounds that these are well covered in other books, and this one is quite long enough already . . .

What is a PhD?

Entering students often think of a PhD as a 'magnum opus', a brilliant research project culminating in a great work. This is an unrealistically demanding model; nobody expects their students to win Nobel Prizes for their doctoral research. As one colleague phrased it, a PhD is less like hacking through the jungle with a machete, and more like crawling around on the ground with a magnifying glass – less major discovery of new lands, more painstakingly detailed investigation of familiar ones.

More realistically, a PhD is a demonstration of research competence – like a driving licence, which shows that you're able to make your way independently, without an instructor next to you on each journey. So, a PhD is a process leading to a professional research qualification. There is no implication that it is the end of your education or training, but it's a significant – and for many the last – formally assessed point on the journey. It involves doing a substantial chunk of research, writing it up, and then discussing it in a viva with examiners who have expertise in the field. You have supervisors to help and advise you, but in theory at least the PhD is something for which you take the initiative, and so it is a demonstration of your ability to do proper research independently. The process is rarely smooth; along the way you will learn a great deal about how *not* to do research as well as about how to do it well.

At a sordidly practical level, the PhD suggests that you are good enough at research to be appointable to a university post. A PhD is highly advisable for a career as an academic, and helpful for a career as a researcher in industry. PhDs are recognised around the world and tend to have pretty good quality control, so a PhD from one country will be recognised in another without too much snobbery. Still at the practical level, if you have a PhD, you usually go onto a higher pay scale.

There are also other views of a PhD. It can be viewed as an initiation rite, in which you undergo an ordeal and, if you come through the ordeal in a creditable

manner, are admitted to membership of the academic clan. Continuing the analogy, having a PhD will not be enough to make you a clan elder, but it will mark the transition to full adulthood. You are treated differently if you have a PhD – there is a distinct feeling of having become 'one of us'.

The 'rite of passage' is not just a snobbery thing; the ordeal (and the education) give you a different way of thinking. A PhD can be viewed as one's entry into the research discourse (which equates roughly to the research community's dialogue about what it believes it knows and has a good basis for knowing). What it should do is prepare you to consider and debate what you know and how you know it. This means that you'll have developed your critical thinking, that you'll have learned about weighing evidence and questioning assumptions. You will gradually notice a different way of thinking about things, such as when you start making administrative decisions in your subsequent career. A good example of this is undergraduate student projects: in many departments, staff with PhDs typically want to use the projects as a way of teaching the students how to conduct research, and staff without PhDs typically want to use the projects as a chance to give the students an industrial placement. The PhDs' view is that the students need to learn critical thinking skills valuable for later life; the other view is that the students need to be equipped to find jobs. Which is right? This is a good question, and one which would take us on a lengthy diversion. The main point is that doing a PhD *does* change you.

So, a PhD can be many things: research training, springboard for specialist expertise, rite of passage, job credential . . . what it means for you depends on which opportunities you seize, whether you keep an eye on 'the Big Picture', what sorts of relationships you form, and so on. So, how can you make it into what you need it to be?

The next sections describe some concepts which we have found invaluable, but which don't usually appear in other books. These provide a useful structure for (a) what you are trying to do in a PhD and (b) understanding how things work in the Big Picture. The first of these is the cabinet-making metaphor; the second is the distinction between instrumental and expressive behaviour.

Terminology: a brief digression

There are various types of research degree; what they have in common is that, as a core component, they involve research by the student. This is different from a taught degree where there may be a research project (for instance, an MSc project), but where this research project is only one component among many on the course.

Strictly speaking, a research degree involves a *thesis,* which is the argument that you propose as a result of your research. Again, strictly speaking, the *dissertation* is the written document which describes your thesis. In common usage, the dissertation is often referred to as 'the thesis'. It's worth knowing about the distinction in case you have a particularly pedantic external examiner – it helps you get off to a better start.

Cabinet-making – the PhD as a 'master piece'

Doing a PhD has a lot in common with traditional cabinet-making. Back in The Past, the apprentice cabinet-maker would finish the apprenticeship by making a cabinet which demonstrated all the skills needed to be a master cabinet-maker. This piece of work was known as the 'master piece'. A successfully defended PhD dissertation fulfils a similar role. It demonstrates that you have all the skills needed to be a researcher in your own right. The issue of *demonstration* is essential. The basis of the PhD examination is the dissertation, together with the subsequent *viva voce* examination. You need to have produced a good enough piece of work, and you need to show your understanding of why it was good.

You therefore need to know what the required skills are for your branch of academia (since different disciplines require different skills) and make sure that you demonstrate mastery of each of these somewhere in your thesis. If you're methodically inclined, you can draw up a list of the skills and tick off each one as it is covered in your thesis. For a cabinet-maker, the skills required would include things like making various complex joints, fitting hinges neatly, applying veneer, and so forth. For an academic, the skills are things like mastery of formal academic language, familiarity with the relevant literature in the discipline, knowledge of the main data collection techniques, adherence to the standards of rigour, and so on. (We talk more about research skills in Chapter 3.)

Things which do not normally appear on the list include personal interest in the area and the ethical importance of the topic. There is no point in going on about these at length in your thesis – you are awarded a PhD as an acknowledgement that you can make cabinets at master cabinet-maker level, not an acknowledgement that you find cabinet-making fascinating, or that cabinets make the world a better place. In practice, few people would spend several years of their life doing a PhD on a topic which held no interest for them, so personal interest is usually taken for granted by examiners. Ethics is a more interesting question. One reason why examiners tend not to take account of claims about the ethical importance of a question (e.g. finding a cure for cancer) as a criterion for assessing a PhD is that bad research can actually impede the search for an answer to the problem by leading other researchers in the wrong direction. Bad research into a highly ethical question is still bad research. Back to the main theme.

Different disciplines have different required skills. Most experienced researchers are so familiar with these that they take them for granted, and would be hard pressed to produce a list from memory over a physical or metaphorical cup of coffee. However, other experienced researchers (especially those who teach research methods courses) will be able to give you some answers. In addition, it is worth having a look at the contents section of research methods books in your discipline, which will cover most of the main topics. The PhD regulations for your institution should also help.

An illustrative list of typical skills is given below. It's illustrative rather than definitive – your discipline will almost certainly have a different list. However,

many of the skills will be the same, and the list will give you the general idea. A pragmatic recap of our top tips is gathered in Table 1.1 at the end of the chapter.

Most of the skills below assume that your work will be located within a single discipline. There is a reason for this. Interdisciplinary PhDs can be extremely interesting and useful. However, they need to be handled with care, since otherwise there is the risk that they will 'fall between two stools'. This can be a problem in terms of practical matters such as finding an external examiner, and in terms of theoretical issues such as deciding which approach to follow when the different disciplines involved have very different ways of doing things. It is usually much wiser to decide on a 'host' discipline, locate the interdisciplinary PhD within that, and then import the concepts from the other discipline into the host discipline.

Cabinet-making skills

Most disciplines require most of the following skills, although individual cases will vary.

Framing an appropriate and useful research question

At the heart of any research is the research question. The quality of output hinges on the quality of the question: why it is asked, how it is asked, how it relates to other questions and knowledge, and what might constitute an answer. Hence, one key skill is the demonstration of the ability to develop a well-formulated question. You'll need to provide evidence of:

- Articulation of the motivation and significance of the question
- Situation in existing literature: coverage and limitations of existing and competing research, awareness of where your work fits in relation to the discipline and what it contributes to the discipline
- Identification and critique of alternative approaches.

Use of academic language

An important part of research is engaging in the discourse: communicating research ideas, processes and results so that they may be scrutinised and discussed. Good communication relies on understanding the conventions of the community. Hence, one key skill is the demonstration of competent academic language. This includes:

- Correct use of technical terms
- Attention to detail in punctuation, grammar, etc.
- Attention to use of typographic design (white space, layout, headings styles) to make the text accessible

- An ability to structure and convey a clear and coherent argument, including attention to the use of 'signposting' devices such as headings to make the structure accessible
- Writing in a suitable academic 'voice'.

Knowledge of background literature

Research is not conducted in isolation; it happens in a context of prior thinking, prior knowledge, prior evidence, prior practice. One key skill is the demonstration of an awareness of that context and of how it shapes your own research. This includes:

- Seminal texts correctly cited, with evidence that you have read them and evaluated them critically
- References accurately reflecting the growth of the literature from the seminal texts to the present day
- Identification of key recent texts on which your own PhD is based, showing both how these contribute to your thesis and how your thesis is different from them
- Relevant texts and concepts from other disciplines cited
- Organisation of all of the cited literature into a coherent, critical structure, showing both that you can make sense of the literature – identifying conceptual relationships and themes, recognising gaps – and that you understand what is important.

Research methods

Any established discipline has a tradition of practice, in the sense of how things are done. Many disciplines have established methodologies which prescribe the selection, combination and sequencing of the methods and techniques to be employed. Others select methods and techniques less prescriptively and borrow more broadly across domain boundaries. All disciplines require an appropriate application of methods in order to ensure rigour. Hence, one key skill is the demonstration of appropriate knowledge and competence in choosing and using research methods. This skill includes:

- Knowledge of the main research methods used in your discipline, including data collection, record-keeping and data analysis
- Knowledge of what constitutes 'evidence' in your discipline, and of what is acceptable as a knowledge claim
- Detailed knowledge – and competent application – of at least one method
- Critical analysis of one of the standard methods in your discipline, showing that you understand both its strengths and its limitations.

Theory

Again, research is conducted in a context of existing ideas, evidence and thinking. One key skill is the demonstration of cognisance of the theoretical context and of how it shapes your own research, including:

- Understanding of key theoretical strands and theoretical concepts in your discipline
- Understanding how theory shapes your research question
- Ability to contribute something useful to the theoretical debate in your area.

Researcher maturity

Part of a PhD is confirming your 'research independence'. You need to demonstrate your:

- Ability to do all the above yourself, rather than simply doing what your supervisor tells you
- Awareness of where your work fits in relation to the discipline, and what it contributes to the discipline
- Mature overview of the discipline.

Instrumental and expressive behaviour

Instrumental and expressive behaviour are invaluable concepts that Gordon bumped into a couple of times, in situations where he had no need to note the full bibliographic reference for the texts involved. They later turned out to be very useful indeed, but he wasn't able to track down those original texts. This was embarrassing for him when students asked him for the source of these concepts (though he did later track down the literature from which they came). This is (a) why we go on at such length about the need for proper bibliographic references for everything you read, and (b) the principal reason for the lack of a proper bibliographic reference for the work discussed below.

The author of the chapter was a sociologist who was studying the de Leonists. Some of their behaviour made little sense to him. For instance, they once spent a lot of time putting up posters around the city advertising a talk which had already taken place. Eventually he realised that they were engaging in what he called *expressive*, rather than *instrumental*, behaviour. Instrumental behaviour consists of actions leading towards a stated goal; for instance, the goal of learning to drive a car might involve the instrumental behaviours of booking driving lessons, buying a copy of the *Highway Code*, and so on. Measured against this criterion, the de Leonists' behaviour appeared senseless. Expressive behaviour, on the other hand, consists of actions demonstrating to

other people what sort of person you are; for instance, sitting in the front of a lecture theatre and taking copious notes in a very visible manner to show that you take your studies very seriously. Against this criterion, the de Leonists' behaviour made a lot more sense; much of it was intended to demonstrate group loyalty, and was intended for other members of the group to see. Sticking up large numbers of posters publicising an event which had already happened could therefore be a good way of demonstrating that you were a committed member of the group and, in consequence, of increasing your standing within the group.

Instrumental behaviour and expressive behaviour are both important. In our experience, students are normally good at some types of instrumental behaviour and woefully bad at various sorts of expressive behaviour, usually because nobody has explained to them which signals they need to send out.

An example of this is the use of bibliographic referencing. At an instrumental level this is important, because inadequate referencing can lead to your being unable to relocate a key text which you read earlier; it is also important for other people who might want to follow up one of your points, or to check one of your assertions (external examiners for PhDs, for instance, often want to do this). At an expressive level, good referencing is also important: it sends out signals saying that you take core academic values seriously, that you are familiar with the core craft skills, that you are thorough and professional, and so forth.

More often, however, students engage in expressive behaviours which send out signals such as 'look how hard I'm trying' – spending all day every day in the library, for example, regardless of whether what they are reading is particularly useful or not. The usual sequence of events is that the supervisor sooner or later notices that the student is not making any progress, and points this out; the student reacts by even more expressive behaviour sending out the same signal; the supervisor notices continuing lack of progress; and so on, until what is, usually, an unhappy ending. What students in this situation need to realise is that the problem is not how hard they are trying, but what they are omitting to do. One large part of this book is about the instrumental skills which are needed to do a good PhD, and another large part is about the signals of skilled professionalism which you need to send out via the right sort of expressive behaviour. (There is also yet another large part, which is about identifying the wrong sorts of expressive behaviour, and about what to do to rectify them.)

Necessary skills

Those readers who are familiar with *1066 and All That* will be pleased to know that skills are currently viewed as a Good Thing. This is especially the case with skills that can be described as 'transferable skills'. You can therefore treat them as a positive asset, to be added to your CV, rather than as another cheerless obligation. Your institutional training course will probably wax eloquent on skills of various sorts – transferable, generic, project-based, and doubtless

many others. Transferable skills are particularly favoured by The System because they are allegedly usable in areas other than just academia. They include (depending on whose versions you receive) writing, public speaking and coping with prejudice.

We'll talk more about the wonderful world of research skills in Chapter 3; the rest of this section describes skills which may not be included on your institution's training programme.

Tact and diplomacy

As a PhD student, you need to accept that you are not exactly at the top of the academic pecking order; as a new PhD student, you are also the new kid on the block. There is therefore a time for being right and a time for using the quiet word that gets you what you want. PhD students tend to do a lot of complaining about how The System treats them (often with some justice on their side), but tend to forget that they are in a system which dates back to the Dark Ages, and which has learnt a thing or two about dealing with complaints. An important skill is to learn when to let something pass and when to stand up (tactfully and politely, but firmly) for an issue. Otherwise, you are likely to find yourself winning the battles and losing the war. For instance, you will probably have complaints about the shortcomings of the library; PhD students almost everywhere have complaints about the library – usually ill-founded – so if you get stroppy about this issue, you are unlikely to get a huge amount of sympathy. ('The library doesn't have many books on my area of interest' usually translates into: 'I haven't learnt yet that I should be reading journal articles at this stage' – not the strongest position for winning an argument.) A second example: you may have grave reservations about the quality of the research methods training course that your institution puts on for PhD students. Bear in mind that PhD training courses are still in their early days, and that a tactless confrontation with the professor responsible for the course is unlikely to produce the result that you need; some suggestions, phrased in a face-saving manner, are more likely to achieve this. Remember also that most PhD students know what they *want*, not what they *need;* there is sometimes an enormous difference between the two. This leads on to another important skill.

Having the right cup of coffee

Probably the most important research tool you will encounter is the cup of coffee. Successful students know this; unsuccessful ones tend to wonder why we're wasting time with jokes, and then wonder why the world is so unfair to them. Knowledge is power; rare knowledge is greater power. The best way of finding out what you really need to know is usually to have a cup of coffee with the right person, and to ask that person's advice (tactfully and diplomatically). Who is the right person? Someone with the knowledge, which in most situations means someone who is not another PhD student. If someone is still a student, then you can't be sure whether the advice is sincere and right, or sincere and

mistaken, since (no matter how helpful and friendly) that student has not yet completed a PhD successfully. There are a lot of folk myths in circulation among PhD students. Fellow students are a good source of social support, and of help with skills such as statistical methods, and with tasks like independent judging for data analysis, or with babysitting; they're not a good source of advice about what your thesis should look like, or where to find the equipment you need for your next bit of fieldwork. The right person is someone who has a successful track record in the relevant topic, such as supervisors whose students usually have happy endings, chief technicians with a reputation for producing the right bit of kit when all hope seemed gone, and librarians who have helped your friends to find obscure but essential references. Show them due appreciation and treat their advice as confidential unless they specify otherwise. The most useful knowledge is often the sort that people will not want to be quoted on.

Asking the right research question

Once you learn this skill, life becomes very different. We have an entire section on this elsewhere because it's so important; we mention it here because it's well worth mentioning twice. So is the skill of asking the *next* question. The real insights often come in the follow-up and validation – by not being satisfied with the first result, but by investigating its implications and limitations.

Academic writing

Writing is indeed a transferable skill; you can transfer academic writing skills from one academic setting to another, and you can transfer business writing skills from one business setting to another. It is quite possible that there are areas where you can even transfer academic writing skills appropriately to industry or vice versa.

Most students know that a PhD requires good science, or good archival research, or good engineering or good disciplinary research of whatever flavour. Many forget that it also requires good 'story-telling'. Getting the form and voice of the dissertation right is just as important as getting the content right in showing mastery, rigour and insight; indeed, they are essential to conveying the content. The dissertation is the 'highest form' of academic writing, requiring content, precision, substantiation and mastery of context beyond what is normally required in individual published papers. It is a 'master piece', not in the sense of an 'ultimate work', but in the sense of a piece that qualifies an apprentice to be called a master through its demonstration of techniques, skills, form and function.

Filling in forms

Forms are a sort of tax you pay for belonging to (and being supported by) an organisation. Academia has an insatiable appetite for forms, which it associates with quality control and due process (and which students associate with

racks and thumbscrews). 'Doing' forms well and promptly can make you many friends – the sort of friends (administrators, budget-holders, tutors and deans) who can smooth your way when it comes to really getting things done. So come to terms with forms as an easy way to show goodwill, and learn to deal with them with dispatch.

Some useful habits, in no particular order:

- Read every form through to the end before starting to fill it in.
- Know the audience – knowing who is going to read the form and with what purpose can help you complete it efficiently and avoid pitfalls.
- If the form is important and you only have one copy, photocopy it, and fill in the copy as a practice run before filling in the final version. If the form is online, it might be wise to draft your answers elsewhere to ensure you're happy with them before submitting them online.
- If you're not sure what a particular section means, then refer to the notes – most forms have accompanying notes which most people don't bother to read.
- If you're not sure what sorts of answers are required, then see if you can source an example of a successfully completed form to use as a model (e.g. from another student).
- Complete internal administrative forms as minimally as possible – imagine someone reading 50 of them and you'll understand why concise bullet lists are generally preferable to wordy narratives for standard forms like expenses claims, stationery requests, progress reports and travel reports.
- Know the exceptions to the previous tip (such as grant proposals, fellowship applications and cases for awards) – but keep narratives concise.
- Read over the completed form (you'll be surprised how many stupid slips you can make); if it is an online form, check your entries carefully before pressing 'submit'.
- If you find forms terrifying, ask someone to help you; if your fear is intense, then consider asking for help from someone who deals with phobias – the process is usually fast and surprisingly pleasant.
- Photocopy or save a PDF of every form that you fill in, after you have completed it, and keep the copies filed neatly – they can be useful reminders for how to fill in the forms, as well as a record of what you claimed last time.

Criteria for a PhD: some reassurance

PhD students often worry about whether their research will be good enough for a PhD. It's useful to remember the criteria which most universities have at the core of their PhD assessment: 'original work' that makes 'a significant contribution to knowledge'. It is no coincidence that most refereed journals and conferences use similar criteria – such publications are notionally how the research

community communicates and continues to build knowledge. Therefore, you can provide evidence of 'significance', 'originality' and 'contribution to knowledge' in advance of submission of your thesis by publishing your work in refereed journals or conferences. There is more on this at various places later in this book. You don't need to make a major discovery to get a PhD – you just need to show that you're able to do good enough research independently.

Key dissertation ingredients

A number of ingredients are essential for a satisfactory dissertation:

- A thesis: one coherent overriding 'story' or argument that embodies a research insight
- Situation in existing knowledge: a critical review of prior research which motivates and justifies the research question
- Contribution of something new: the 'significant contribution to knowledge'
- Appropriate voice and argument: the provision of clear and explicit evidence, substantiation, and chain of inference.

More hangs on the student's ability to demonstrate intellectual maturity and critical depth – and through them to provide insight – than on the scale or scope of the research findings. A good PhD is based on an honest report of research that reflects sound practice and well-articulated critical thinking.

What is a 'significant' contribution?

Most students, when they hear the phrase 'significant contribution', think in terms of a new theory, crucial experiments, technological breakthroughs. For a PhD, the truth is that 'significant' need not mean 'revolutionary' or 'major' or even 'large'. The phrase might be more accurately read as 'significant – albeit modest – contribution'.

Characterising your contribution means answering 'So what?', which means articulating:

- The importance of the question (Why is it worth asking?)
- The significance of the findings (Why do they matter? So what?)
- Their implications for theory
- The limitations to generalisation.

Making a 'significant contribution' means 'adding to knowledge' or 'contributing to the discourse' – that is, providing evidence to substantiate a conclusion that's worth making. Research is not something done in isolation; it is a discourse among many researchers, each providing evidence and argument that contributes to knowledge and understanding, each critiquing the available evidence. Research is about the articulation and analysis of phenomena observed

and investigated through a variety of techniques. It's about 'making sense' of the world: not just describing it, but also analysing and explaining it. As more evidence is presented, the analysis and explanations are re-evaluated. Knowledge claims can be small and still have a role in the discourse.

What sorts of contribution are typically made in dissertations?

- Re-contextualisation of an existing technique, theory, or model (applying a technique in a new context, testing a theory in a new setting, showing the applicability of a model to a new situation): showing it works – or that it doesn't – and why
- Corroboration and elaboration of an existing model (e.g. evaluating the effects of a change of condition; experimental assessment of one aspect of a model)
- Falsification or contradiction of an existing model, or part of one
- Drawing together two or more existing ideas and showing that their combination reveals something new and useful
- Demonstration of a concept: showing that something is feasible and has utility (or showing that something is infeasible and explaining why it fails)
- Implementation of theoretical principle: showing how it can be applied in practice; making concrete someone else's idea, and hence showing how it works in practice and what its limitations are
- Codification of the 'obvious': providing evidence about what 'everyone knows' (possibly providing evidence that received wisdom is incorrect)
- Empirically based characterisation of a phenomenon of interest (e.g. detailed, critical, analytic account of the evolution of an idea; detailed analytic characterisation of a crucial case study or a novel chemical compound, or a new planet)
- Providing a taxonomy of observed phenomena
- Well-founded critique of existing theory, or evidence (e.g. correlating the results of a number of existing studies to show patterns, omissions, biases, etc.)
- Providing a new solution to a known problem (and demonstrating its efficacy) – even an obscure one; conceiving and justifying a new explanation for a problematic phenomenon
- Filling a small technical gap (e.g. showing that a 'tweak' to an algorithm or technique is more effective or developing a novel methodology).

The key is that, although the dissertation must stand alone in presenting your research, the research doesn't exist in isolation. Doing research means contributing to the discourse – adding knowledge that moves the discourse along. We say that 'research proceeds by baby steps' and that 'researchers stand on each other's shoulders'. A 'significant contribution' is a baby step, one that combines with the baby steps of others to produce progress. As a rule of thumb, a decent PhD should yield at least one sound paper in a strong, peer-reviewed journal.

Table 1.1 Ten top tips for research students

Read, read, read	Seasoned researchers typically have an evolving 'reference set' of around 100–150 papers which forms the core of the relevant literature in their specialty, and with which they are conversant. Students need to read enough to form an initial reference set.
Write, write, write	• Writing needs practice: the more you write, the easier it gets. • Write up as you go; this will both make it easier at the end (when you rewrite it all) and give you something to show people who are interested in your work. • Don't throw writing away or delete drafts; date it and save it in an 'out-takes' file – that material can be useful. • Revising is often easier than writing new.
Keep an annotated bibliography	This is the single most powerful research tool you can give yourself. It should be a personal tool, including all the usual bibliographic information, the date when you read the paper and notes on what *you* found interesting/seminal/infuriating about it. Consider using one of the many labour-saving software packages available to you for storing citations and creating digital bibliographic records.
Form an 'informal committee'	Find some reliable, interested people who are willing to read for you, comment on ideas, bring literature to your attention, introduce you to other researchers, and so on. They may be specialists who can provide expertise on which you can draw, or generalists who ask tough questions.
Expose your work	Make your work public in technical reports, research seminars and conference papers. The best way to get information is to share information; if people understand what your ideas are, they can respond to them. Making your work public exposes you to questions and criticism early (when it can do you some good), helps you to network and gather leads, and gives you practice articulating your reasoning. Add links to your peer-reviewed published work to your university's online repository and your department's homepage (if they have them), and to your professional profiles on social media.
So what? Learn to ask the other questions	Students often get a result and forget to take the next step. 'Look, I got a correlation!' *'So what?'* Learn to go beyond your initial question, learn to invert the question in order to expose other perspectives, and learn to look for alternative explanations.

(continued)

Table 1.1 (continued)

Never hide from your supervisor	'Hiding' is a pathological behaviour in which most research students indulge at some point. Communicating with your supervisor[s] is a prerequisite to getting the most out of them.
Always make backups (and keep a set off-site)	More than one student has had to re-start writing from scratch or to repeat empirical work because of not making backups. Ensure that your work is saved on more than one device and in more than one physical location.
Read at least one completed dissertation cover-to-cover	Reading something that has 'passed' is an excellent way to reflect on dissertation structure, content, and style – and on 'what it takes'.
A doctorate is pass/fail	Part of the process is learning when to stop.

Chapter **2**

The many shapes of the PhD

• Phases • Waypoints • Different models of study • Different models of supervision • Different models of theses • The student contract

PhDs are like journeys: each journey is different, even if the intended destination is the same. Below the surface variations, though, there are commonalities. This chapter is about these similarities and differences: different models of PhD study, different models of supervision and different models of theses – and about the commonalities behind these. We'll begin with phases and waypoints.

Phases

A modern PhD can be viewed as having three key phases, each of which contributes a necessary element of mastery.

1. Orientation: working out where you are, and where you want to be

The first phase, 'orientation', concerns mastering the literature (including existing theory and existing evidence), formulating your research problem (and relating it to existing theory and evidence), identifying an appropriate approach for addressing the problem and specifying a plan of work, including a clarification of how 'success' is recognised. In some cases, your research question may have already been specified in a proposal drawn up by your supervisor to secure funding for you. But, even if this is the case, you must become familiar with the literature and able to discuss the relevance of your research question within the context of your discipline.

2. Footslogging

The second phase, 'intensive research', is concerned with conducting a programme of research (whether evidence-gathering or theory development), reasoning accountably and explicitly to reach conclusions, critiquing, iterating and validating your work, and reasoning about generalisation and limitations.

3. Talking to other travellers

The third phase, 'entering the discourse', involves exposing your work to discussion and scrutiny, which means presenting and defending your work both orally and in writing. This takes the form of making paper submissions to conferences and journals, giving research seminars and conference presentations, responding to referees' comments, and ultimately producing, submitting, and defending your dissertation.

Strangely enough, the three phases correspond to three key requirements for a PhD:

- Mastering the discipline – knowing what's already out there
- Planning and conducting sound, informative research
- Communicating research.

You need all three elements in order to earn a PhD, because all three are necessary to making significant contributions.

Waypoints

In addition to the intellectual phases, PhD programmes have a number of administrative steps, basic points along the way that are common in some form to just about all programmes. We use the term 'waypoints' because the more common term 'milestones' is now often used by bureaucracies to refer to specific stages within their own processes.

Induction

When you sign on as a prospective PhD student, the whole process is phrased in terms of your having to make active moves from one stage to another, rather than a default assumption that once you have started a PhD you will automatically end up being examined for one. The earliest phase of a PhD is figuring out the ground rules: orientation to the literature, introduction to expectations and norms, training in basic research methods, figuring out who makes which decisions, coming to terms with The System – the politics, procedures and structures of the institution. Some institutions have a formal induction period, others leave students to work it out for themselves. Students who arrive thinking they know it all are always surprised – either because they pay

attention at induction and ask lots of questions of students who have been around a while, or much later, when they discover the cost of their arrogance (and ignorance).

Research proposal

At some point in the process, you'll have to convince your supervisors, department and institution that you have identified a topic worth pursuing. You'll have to formulate your research proposal: specify a research question to answer or a research problem to solve, justify why it's important enough to bother with, set it in the context of what's already known, and propose a specific method for addressing it. The research proposal is likely to change over time – research rarely goes strictly to plan (otherwise it wouldn't be research). The significance of the research proposal is showing that you know how to pose research questions and propose rigorous ways of answering them.

Transfer/upgrade, or passing probation

Passing probation and transferring or upgrading to registration as a PhD student is an important step, both academically and administratively. Contrary to pessimistic folklore among students, institutions do care about whether their PhD students survive or fail, if only because their completion rate (the proportion of students who actually complete PhDs on time) reflects on the institution and can affect its funding. One simple and effective way of reducing the number of students who fail at the submission and viva stage is to re-route the problem cases before they reach that stage – if they don't reach it, then they can't fail it. The point at which this is done is 'transfer' or 'upgrade', somewhere between the end of your first year and halfway through the PhD, when you should have done enough work for The System to have a fair idea of your ability. (If you haven't done enough work, or it doesn't give a fair idea of your ability, then this suggests that you should be re-routed.) Transfer/upgrade is considered an active process, not a 'rubber stamp'; students need to demonstrate their suitability and earn the approval to continue.

Transfer/upgrade normally involves genuine academic assessment of how you are doing, rather than an administrative convenience. It can take the form of 'qualifying exams' or other formal assessment, a substantial document such as a 'research proposal' or 'probation report', a live performance such as a department seminar or oral examination, a practical demonstration of research skills – or some combination of these or other elements. By amazing coincidence, these things can be viewed as useful practice for proposing and conducting research, writing the dissertation and undertaking the viva. The purpose is to demonstrate your *competence* – not to demonstrate perfection, nor to set your research plan in concrete.

Some students decide, around transfer or probation assessment, that doing a PhD is not for them. An honourable withdrawal, or an informed choice to undertake an MPhil, is actually a success for the student, the supervisors and

The System. It's a much happier option for everyone than years of anxious and often unsuccessful toil.

Annual report

Each year during your doctoral studies, most institutions require your faculty, department, postgraduate tutor or supervisors to submit a report outlining your progress during the year, assessing your continuing potential for PhD completion and making a recommendation about whether or not to continue your registration. The process can be more or less formal, but it involves documentation that Goes On File. A sensible strategy is to view the annual report as a chance to reflect constructively on your progress, not just as an administrative hurdle. In a process that tends to emphasise 'to do' lists, a regular review of the 'done' list can be reassuring and helpful.

Candidate declaration form

Before you can submit your dissertation, you will have to notify your institution formally that you are ready to do so, using a form called something like the 'candidate declaration form'. This form has two major purposes:

1 It requires your supervisors to vouch for the quality of the work, because in signing the form they must declare both that they have read a complete draft and that the work is worthy of examination.
2 It sets the machinery in motion to appoint your examiners, a process which may take some time, because it requires the provision of CVs, completion of forms and approval by relevant committees.

Submission and viva

The PhD is a long process that culminates in one document and one discussion. The document is your dissertation; the discussion is the *viva voce* examination, when you are asked penetrating questions by a panel of bright and knowledgeable examiners. When the academic system decides whether or not you should have a PhD, it does this only by assessing your performance in the dissertation and viva; any other work not represented in them is irrelevant.

Different models of study

Back in The Past, a typical PhD went something like this. You sought out a potential supervisor, introduced your brilliant ideas and then, if the academic thought you were worth taking on, you would start a PhD, quite probably on a totally different topic from the one you originally proposed. You would potter around with whatever level of supervision your supervisor felt like providing and be left pretty much in peace until you either submitted your dissertation

(quite probably on a topic different both from your original brilliant idea and from the one you changed to) or gave up and did something else instead, like becoming a mushroom farmer in Devon. An alternative model was for the department to show a student into a closely packed office, shut the door, open it in three years and demand: 'Are you finished yet?'

Days long past; times long changed. PhD programmes have become far more codified. The models are shaped by the expected place of study (e.g. in an ivory tower, on a university campus, in an industry laboratory, at the kitchen table), by the intensity of study and focus (e.g. full-time, part-time), by the number of influences on the research (e.g. student-directed, part of a larger research project, part of an industry research programme), by the level of intended guidance (e.g. taught introduction, supervision-as-collaboration, largely independent working with infrequent supervision), and by who takes responsibility for skills training (e.g. research-only focus, taught component). We'll discuss some of the most common models.

The essential PhD

The essential PhD – focused on the PhD research, shaped largely, if not exclusively, by the supervisory relationship, with minimal structure and judged only by the final output – is at the core of every PhD, because every PhD student ultimately needs to find their own path up the research mountain. In some places (such as the UK), this is the dominant PhD model, making the supervisory relationship the most important feature of the programme. It is the least specified, and certainly the least structured, of any of the models, but nevertheless includes the basic procedures and waypoints common in some form to all. Some institutions, unwilling to just 'throw them in the deep end', augment the essential PhD with training and development programmes: group supervision and research groups, seminars, courses on research methods and specialist topics, and so on.

Project-based PhD

One of the ways to fund PhDs is to embed them in funded research projects. This has advantages and disadvantages. It has the advantage of creating studentships. It has the disadvantage of tying the PhD into the project goals, and into project politics. It has the advantage of giving the studentship structure and focus. It has the disadvantage that the student has to shape his or her interests to the project specification. It has the advantage of providing the support of a project team and project management. It has the disadvantage of making the PhD one of the project deliverables – and possibly of making the PhD subordinate to the priorities of the project. It has the advantage of providing momentum and accountability. It has the disadvantage of reducing flexibility for the student. And so on. The biggest challenge for a project-based PhD is to maintain a clear sense of identity within the project. Students undertaking project-based PhDs must constantly ask: 'What is my PhD research and how is it distinguished

from the project as a whole? Can I specify clearly where my individual contributions lie?'

PhD with taught components, or masters plus PhD

This model is commonplace in North America, where students spend a year or two 'qualifying' for PhD study by demonstrating mastery of their discipline. This initial period is structured by advanced courses in their specialist topics and punctuated by advanced examinations. Some institutions make this phase explicit through the award of a masters degree; however, some only award the masters degree as a sort of consolation prize to those who do not continue into PhD study. The taught component can be very useful, ensuring that all PhD students demonstrate a comparable degree of competence and sophistication in their discipline before they are sent off into the wilds of research, and reassuring students that they indeed have that competence.

In other formulations – evident, for example, in recent practice in Europe – students spend a year or two earning a taught masters degree as a pre-requisite to a PhD programme, sometimes before they even apply for a PhD. The masters provides either specific research training or advanced study in a topic relevant to the proposed PhD. The subsequent PhD programme can then focus on independent research.

Professional doctorate

Designed for people who wish to combine research with professional practice, these degrees recognise that domain expertise can contribute to research expertise, and that professional practice itself provides a relevant (although perhaps not sufficient) skill set and a context for research in that domain. The degrees are structured to incorporate and exploit that professional activity. They typically include a taught (and assessed) component – filling in the research perspectives and research skills that are not part of the profession – and draw explicitly on the professional practice for examples and data. Although professional PhDs typically rely on the dissertation and oral examination as the summative assessment, they are often satisfied with a shorter, more specific thesis, that links to professional experience.

Industry-based study

These schemes are designed as an academe-industry handshake: academics get to collaborate with non-academic organisations that do cutting-edge research, and organisations that cannot themselves award degrees get academic recognition for their personnel. The students work and research in the organisation and draw on its resources, and their doctoral research is embedded in or associated with the organisation's research. The organisation directs the work, but the university sets the academic standards. There is usually an industry-based supervisor as well as a university-based supervisor. The two

perspectives can create conflicts in terms of practical matters such as priorities, deadlines and intellectual property, and the student can feel isolated, but the richness of the environment and the opportunities it holds can be compelling advantages.

PhDs by publication

This is an umbrella for many different practices. It can be a mechanism for giving academic recognition for a body of published professional work, such as a series of scholarly biographies, or a series of patented or published technological advances, or an implemented, innovative pedagogy. In that case, the dissertation makes the overall case for the significance of the body of work and its contribution to knowledge. The PhD by publication can be a mechanism for exposing doctoral research to peer review before examination, by requiring that the dissertation consist largely of material accepted for publication by high-quality, peer-reviewed journals or conferences. In that case, the dissertation binds the published papers together with a narrative that draws out the resonances and overarching themes between them and locates them in existing knowledge and theory. The PhD by publication can be a minor variant of the monograph dissertation. In many disciplines, it is normal to publish conference and journal papers during PhD study, and the resulting dissertation chapters may owe a great deal to those publications. The PhD by publication just uses the papers explicitly (rather than rewriting them as chapters), weaving them together with an overriding narrative.

Part-time PhDs

Part-time PhDs are a lot like full-time PhDs, only harder, because they must compete with 'the day job', and they typically receive less support. At best, there is a fit between the day job and the PhD, so each can benefit from the other. Such examples may bear some resemblance to professional doctorates or industry-based PhDs. But even in this case there are two masters – the market and academe – with different characters, different languages and different priorities. At worst, the day job and the PhD compete for the same resource: you.

Whatever the model of study, the culmination is always the dissertation and defence, and the outcomes are arguably comparable. Models of study are influenced by national and institutional culture.

Different models of supervision

Supervision is utterly individual and varied. Every supervisory relationship is unique. Students of a given supervisor may have very different views of the person and very different experiences of supervision, just as different children in a given family can sound as though they were raised in quite different households. And yet, there are some common models.

The sole supervisor

In The Past, the supervisory relationship was a closed world. One supervisor 'owned' a student, and others dared not intrude or interfere. This worked very well when the supervisor was excellent. Unfortunately, supervisors were not always excellent, with predictable results. There are still many cases when there is a 'lead' supervisor who oversees day-to-day work and is the primary mentor and contact for the student. However, these relationships are rarely exclusive, and nowadays supervisors are typically accountable to other supervisors or other forms of oversight – and can draw on other experience and expertise.

Joint supervision and its variants

Along the way, The System recognised that supervisors are only human (although some appeared to have come straight out of a horror movie), and that joint supervision can be a good way to compensate for variation among supervisors, distribute responsibility and provide some accountability. Joint supervision can take a variety of forms.

- **1 + 1:** in effect, there are two (or more) supervisors who act independently, meet the student separately, and leave the student to negotiate between them. The student potentially receives twice as much input. This has all the hazards of sole supervision, multiplied by the number of supervisors. The more often the student can negotiate the supervisors into the same room for a joint discussion, the better. A degraded form of this variant is the 'absentee supervisor'. In effect, there are two supervisors on paper only, and the student experiences sole supervision.
- **Specialists:** the supervisors take particular roles relating to their expertise and availability. One may be the generalist and the other the domain expert. One may handle experiment design and the other statistical analysis. One may be the theorist and the other the pragmatist. And so on. This can work well, as long as the roles and decision-making processes are agreed by all, and communication is effective. It helps if all parties meet together at regular intervals.
- **Lead and support:** one supervisor may act as lead supervisor, with other supervisors in supporting roles – for example, providing specialist expertise or acting as readers/reviewers. This can provide clarity for the student: the lead supervisor has the greater voice. But supporting supervisors can become detached and disaffected, leaving things to the lead supervisor even when they might have contributions to make.

Supervisory panels or committees

Supervisory panels or committees can be thought of as combining sole and joint supervision. Most supervision is layered in formal and informal interactions; supervisory committees tend to embody this layering. A committee of experts oversees the research, with the big decisions (the design and direction of the research) made or ratified in formal meetings with the committee. The day-to-day

supervision, however, is provided by an adviser, who tends to manage the activity more informally. This model is common in North America. The advantage is the assembly of expertise – as is the disadvantage. Lots of input may mean lots of opinions, some of which are likely to compete. On the other hand, when the whole committee signs off on something, the student can feel well-founded confidence.

The key to all supervision is communication, assisted by clear lines of responsibility and decision-making. At its best, joint supervision is a profound advantage: the assemblage of supervisors provides a more complete portfolio of expertise and talents, and the redundancy takes the pressure off any individual supervisor, compensating for absences and distractions. The student may appreciate the educational dialogues between supervisors, especially when they argue different perspectives. Clever students can manage the supervisory relationship, using supervisors for what they're best at and enlisting one to help resolve issues with another. We talk more about managing supervisors in Chapter 4. Sinful students try to play off one supervisor against another, and then blame everyone but themselves when the PhD goes horribly wrong. Joint supervision can work very well, but only if you allow it to work and help it to work when it hits problems.

Different models of theses

There are various models of theses, in terms both of the structure of the document and its content, for example:

- The scholarly book, drawing on a host of existing or discovered evidence, discussed thoroughly and woven into a pattern of insights in a compelling narrative
- The collection of publications, threaded together by a unifying discussion
- The engineering model, which solves a problem, often by building a tool, implementing a solution, creating an algorithm or designing a process or method
- The empirically driven model, in which the thesis is justified through (or may emerge from) a series of empirical studies
- The science model, in which a research question is addressed via the application or generation of theory supported by experimental evidence
- The theory-driven model, which presents a new theory, or extends an existing one, and may rely on argument, analysis and illustrative examples, or may draw on empirical evidence
- The mathematical proof, which rests on the importance of the insight and the correctness of the proof.

Clearly, this list is neither definitive nor complete.

Different models are normally associated with different disciplines, with different expectations in, say, mathematics and fine arts, biology and history, archaeology and computing. The differences lie, not just in the length and structure

of the dissertation, but more importantly in the expectations about what sorts of knowledge claims are permitted and what counts as evidence. Differences are reflected in how existing knowledge is presented and discussed, in what sorts of arguments are made, in the balance of theory and evidence, in the nature of evidence presented, and in the scope of the thesis. All of these parameters have different disciplinary interpretations – so, know your discipline.

The student contract

Whether it's explicit or not, accepting a PhD studentship is a form of contract. Just as you have expectations about what will be provided to you as a student (such as supervision and access to library facilities), the university will have expectations about what you will provide (such as your presence, adherence to regulations, and observance of processes and procedures). It behooves you to understand the terms of that 'contract', to engage with the regulations and guidance, and to behave professionally – even when the rules may seem silly, or others may behave to a lesser standard. Three key elements of the student contract are Intellectual Property, regulations, and processes and procedures.

Intellectual Property (IP)

In brief, if you invent or create something, then it is Intellectual Property. Different countries have different laws about what counts as IP. Different forms of IP may be covered by different rights and laws (e.g. patents cover inventions; copyright covers physical expression of ideas). IP can be worth money, so when you sign up for a PhD, there will be something in the paperwork about who owns any IP that you produce.

If you're doing a standard PhD, a common pattern assigns the IP to the university, but income arising from that IP will be shared with you. Usually, the arrangement applies only to inventions that relate to the PhD. So, for instance, if you're doing a PhD in biochemistry and you invent a new musical instrument unrelated to the PhD, the IP will probably belong to you. If you're doing a PhD sponsored by a commercial company, then there will be a separate agreement (because the company's contract with the university may assign the IP to the company). If you're doing a PhD funded by a grant, then again there will be a separate agreement with the funding agency. Whatever the case, you need to read the paperwork and understand the terms.

Copyright is a particular form of IP right, giving the owner of a created work – such as a paper, book, picture, website, song, poem – control over how it can be used. Student contracts vary in their handling of copyright: some require students to assign copyright to the university; others leave it with the student. Therefore, before you can publish your research, you need to know whether you have the right to sign a copyright agreement.

That's the short version; the full version is much longer. If there's any likelihood of your creating IP in your PhD, you should sort out the arrangements for

handling it as soon as possible; it's much easier to do this at the beginning, before things get complicated.

A standard disclaimer: We are not lawyers, and we disclaim all responsibility for any bad things that arise from the advice above.

Regulations

Each institution has its own regulations. Read yours – you've agreed to abide by them as part of your student contract. It's no good complaining down the line that 'nobody told me'.

Processes and procedures

Academia is bureaucratic. Processes and procedures are persistent – they'll still be around when you're not. The result is that you will probably have to go through procedures that appear cumbersome and pointless to you, however well-intentioned and important they might be. Our advice is to cooperate with them, however much or little sense they seem to make. If they don't seem to make much sense, cooperate with them all the same and save your energy for other battles. Or, ask gentle questions and perhaps discover that there is a point and purpose of which you were simply unaware. If nothing else, you might learn something about the arcane mechanisms of institutions. Fill in the forms neatly, hand them in before the deadline and, essentially, show the skills that you need to show.

Keeping processes and procedures in perspective is a form of 'research hygiene', and more tips for maintaining a healthy research life are offered in Table 2.1.

Table 2.1 Research hygiene – or 'good research record-keeping practices' to preserve your intellectual and mental health

Good record-keeping practice should be a valued servant, not a bad master. Experiment until you find practices that work for you, and your life will then improve significantly. The ones below are a good starting point.

Accumulate ideas	Collect and collate ideas. Ideas come from many sources – from the literature, from empirical work, from practice, from impromptu conversations on the bus. Good researchers organise and filter their ideas. Important ideas must be distinguished. Competing ideas must be understood. Ideas that are pertinent and useful to one's own research must be selected for attention. One part of making sense of a literature is to notice patterns of repeated ideas – and competing threads. Prioritise the ideas in terms of their relevance (to your research), their feasibility (within the constraints of your research resources) and their importance (potential impact).
Keep a progress record	One useful form is just a document of bullet lists of accomplishments, ideas and activities within a period. Whenever you accomplish something, note it in the record. A list is a good reality check, and makes it easy to compile reports such as annual progress reports (and hence to reflect on how you've been doing).
Keep an annotated bibliography	• Keep it up-to-date – it may seem time-consuming now, but it will save you time and hassle in the future. • Read as if refereeing: make notes as though for a critical review. • Recognise that your reading changes as your knowledge and context change; keep notes that can reflect that evolution of perspective. • Read deliberately from different perspectives. • Keep track of papers that aren't relevant so that you know you've seen them and made a judgement to exclude them. • Referencing software can help you to search, save, annotate, and format references. Given the instability of some online resources, save printed or electronic copies of papers in your own file store (or you can gamble and save lists of URLs to return to later).

(continued)

Table 2.1 (continued)

Email weekly updates to your supervisors	Good updates tend to be short, just a couple of lines to say what you did in the past week, note any concerns and set out the plan for the coming week. They are a way of 'staying honest' with yourself and your supervisors, and they provide useful information that can help your supervisors help you. They are especially important for part-time students.
Draft your thesis outline and abstract once you've passed probation, and update them regularly	Updating your outline and abstract is a good means of reflecting on your 'great overall scheme of things', and the successive versions give you a powerful record of how your thinking develops over time.
Keep an ordered to-do list	Sort your to-do list (e.g. put each item on a Post-it and sort them into groups, or use a task-management application): prioritise what is *urgent* and *important.* Specify your targets; establish what 'success' looks like. 'The trick to finishing is to keep starting things': start with something easy to achieve.
Make backups regularly, and in multiple locations	If you save your work locally on your device, then backup regularly to an external hard drive or multiple devices stored in different locations. (Automatic backup software can help.) Saving your work automatically to a cloud storage service reduces the need to make regular backups, but you need to ensure that the service is reliable, secure, and encrypted (and not in breach of university policy). And you may still decide that saving manually to another location provides additional safety.

Chapter 3

PhDs as master pieces

• The dissertation (and viva) as master piece • Independence does not mean isolation • How skills are embodied in the research programme and dissertation • Developing and documenting skills • How to become an international researcher

Back in The Past, supervision and study on a PhD were very much the academic equivalent of artisan skills; every PhD, every supervisor, and every student did things pretty much their own way, with variable but often interesting results. The only real constant was the focus on the PhD being of suitable quality, where 'suitable quality' was largely defined by the professional judgement of the examiners.

That was The Past. Now, there are more stakeholders in the PhD process (including funding bodies, employers, and government), giving rise to procedures to ensure standardisation and what is hopefully called 'quality assurance'. This has reduced the number of spectacular failures, but at the cost of making spectacular successes and innovative thinking more difficult to achieve. The System is also now more explicitly focused on 'employability' of graduates, which is usually as poorly defined as 'suitable quality' was in The Past.

The dissertation (and viva) as master piece

Regardless of the agenda, the PhD is a long process which culminates in the dissertation and *viva voce* examination. The decision about whether or not you should receive a PhD is based only on assessing your performance in the

dissertation and the viva, which is meant to embody and represent all your other endeavour – together, they are the *master piece* that qualifies a research apprentice to be called a 'doctor of philosophy'. There are three main ways in which people tend to view this:

- You still need to concentrate on each stage and do each properly, because otherwise you won't get to the submission and viva stage.
- All that really matters is the dissertation and the viva, as long as you get through the previous stages somehow.
- All of this is preparation for what you do after you get through the PhD.

The first of these views is popular among administrators and among nervous students (who probably constitute the majority of PhD students), since it reduces the risk of people crashing into early hurdles because they didn't aim to jump high enough. The second is less popular, but is more accurate (as long as you understand that the concept of 'good enough' does not mean 'don't bother'), though it's open to misinterpretation, which can cause you needless grief (for instance, failing to realise that dealing with procedures is an essential skill, and that the consequences of failing to engage when necessary can be catastrophic). The third is the least popular, but is actually the one which will stand you in best stead both for the PhD itself and for life afterwards. The third view is what this chapter is about: understanding that underpinning your ability to produce a passable dissertation and defence is a collection of research skills that you need to learn – and to learn to demonstrate.

Here's a classic story about what's wrong with the second view. A student focuses clearly, submits the dissertation and starts looking for a lecturing job, only to discover that any future job in a good department in that field requires two years of lecturing experience and preferably a journal publication as well. If the student had known this two years previously, it would have been possible to start doing some part-time lecturing and to submit a paper or two to a journal. Here's another one: a student starts looking for a job in industry, only to find that the job requires team-working experience, people skills and experience of different research methods. Again, had the student spotted this earlier, it would have been possible to arrange appropriate experience and perhaps an industry internship. The dissertation and viva are the things that get you the PhD, but it's also wise to think about ways of doing a PhD which set you up for the job or career that you want.

That's why the long view is important. If you look at it constructively, it's about becoming a rounded, independent researcher. It's also about remembering that life doesn't end with the successful viva – the day of your successful viva is the first day of the rest of your life. There is a life after the PhD, one worth considering in advance. (And there is also life without a PhD, if you decide that it's not for you, or if circumstances intervene; planning ahead can reduce stress and identify positive opportunities.)

Independence does *not* mean isolation

Being an 'independent researcher' means having the knowledge, skills, critical thinking and initiative to design and conduct rigorous research (as rigour is understood in your discipline).

But independence doesn't mean working alone, it means having the competence to initiate, design, and lead a research project. Technical skills are only part of the picture. Most research is done in social settings, and so part of the skill set has to do with knowing the 'rules of the game' in the academic or industrial research community you hope to join, and having the social and organisational skills to operate effectively within that community.

Independence does *not* mean doing everything yourself, without reference to anyone else or anyone else's work. In fact, working in determined and persistent isolation is almost an anti-skill. It suggests a lack of key competencies. There's a reason why we keep talking about 'research discourse'. Students who shut themselves away from dialogue and interaction tend to end up out of touch with the research community. Yet it is the community, ultimately, in the form of examiners, reviewers and referees, that assesses the research, so learning how to express one's ideas and findings and get them into that community's discourse is a fundamental research skill. Communication is a necessary component of research, and like all skills it needs practice.

It's not 'cheating' to consult other people, debate ideas and get expert advice – it's competence. It's an important part of the process of reflection that is essential to becoming expert.

How skills are embodied in the research programme and dissertation

You might not be surprised to know that researchers developed research expertise in the days before research skills were taught explicitly. The development of the knowledge and skills necessary to become an independent researcher is a natural outcome of good supervision – the real 'change of agenda' is not the introduction of skills training, but just the explicit attention to it. For example, we've done an implicit initial skills audit at first meetings with our own students for years. It goes something like this. Can the student read academic articles (and report accurately what he/she read)? Can the student write (preferably in clear academic English)? Can the student answer questions intelligently? We used to think of it as 'sizing a student up', and if we noticed any deficiencies we'd structure the early supervision accordingly, guiding the student through reading, writing and argumentation tasks. We just never talked about it.

So what's different? Making it explicit. Asking students to reflect periodically on what they need, then laying plans to address those needs, and finally documenting some evidence that skills have improved sufficiently. The key part is

getting students to pay attention, and to reflect periodically on themselves as rounded researchers.

The dissertation and viva are two of the most important pieces of 'evidence of skill' that students accumulate. Like 'master pieces', they are explicit demonstrations of necessary skills: posing well-formed questions, making sense of existing knowledge, theory, and practice in the domain, critiquing it, building on it and relating one's work to it, formulating a plan of research appropriate to the questions, conducting that research rigorously and effectively, analysing outcomes, discussing limitations and implications, generalising from that research to propose enhancements to theory, articulating and defending one's reasoning, communicating research clearly, and so on.

As for all those annoying bureaucratic waypoints, like transfer/probation assessment, seminars and annual reports, these are also pieces of evidence, like a benevolent conspiracy to make students show that they know what they're doing. And that is why a PhD is not just a 'significant contribution to knowledge'; it is also a demonstration of research competence.

Developing and documenting skills

Skills are not just one thing. There are different levels of skills, such as generic or transferable skills (meant to cut across all disciplines), discipline skills (relating to norms and practices within a given discipline – for example, not everyone needs to know about the finer points of lab coats as part of their health and safety competence), and project skills (those needed specifically to conduct a given piece of research – e.g. not everyone needs to program Java applets).

And of course time plays a role. Not only do skills change and develop over the course of PhD study, but also the threshold for 'competence' varies for different roles and projects. Skills development is not a one-off action like inoculation. It's iterative, with small steps and activities which gradually accumulate and consolidate into an embedded skill – which then continues to be developed and refined. If you want to do it consciously and reflectively, then you'll be looking at both short-term and long-term targets, tailored to your personal goals and your research project. It helps if you prioritise a small number of targets at a time, and if your targets are concrete, with specified outputs and deadlines.

Skills tend to be expressed in fairly abstract terms. It's a good idea to find and look at the current set for your institution, or the latest set of government guidelines. A typical example is: 'The ability to recognise and validate problems'. What might that look like in the wild?

- Can you identify the research questions addressed in the research papers that you read?
- Have you clearly defined the research question(s) you will pursue in your PhD?

- Can you develop valid research hypotheses from your research question?
- Can you:
  - give examples from the literature of problems which have been addressed by others?
  - explain why those researchers addressed the problems as they did?
  - discuss advantages and disadvantages of those approaches?
- Can you explain the sorts of evidence and/or arguments that are seen as valid in your field?
- Can you design a research study which addresses one of those research questions?

If you can do all that, you can probably claim some competence in 'The ability to recognise and validate problems'. And, in doing so, you'll probably generate evidence of that skill in use, such as notes from a discussion with your supervisor about gaps in the literature or a written analysis of problems addressed in a selection of studies, with a description of how the problems were addressed, and a discussion of the benefits and limitations of those approaches.

Thinking about the manifest forms of skills not only gives you an idea of what they might mean and how they might be relevant for you, but it also suggests activities you might undertake to develop those skills. A crucial part of this process is reflection and discussion – considering which skills to prioritise and how to go about developing them gives you something concrete and achievable to talk about with your supervisors.

Most people do this implicitly. Most academics have a 'portfolio of evidence' of skills, by whatever name. They'll have a file of papers they've published (and some unpublished ones), slides and notes from talks they've given, a record of the grant proposals they've submitted, a CV they keep up to date, and so on. This is useful when job interviewers ask for examples, such as 'Can you give me an example of when you've worked in a team?' Documenting your skills is itself a skill, and a valuable one.

How to become an international researcher

Why stop at independence? If you want a research career, then you'll want to build an international research reputation. This isn't something you'll necessarily achieve during your PhD studies, but you can certainly lay the groundwork and orient yourself to take a strategic view of your research.

Know the tools of your trade in detail

Most researchers learn enough about the tools of their trade to get by. This isn't enough. The more you know about them, the better the work you can do, and the more easily you can do it.

Study a role model

Find one or two people in your field whose position you admire. Investigate their publications. Where do they publish? What do they do? Which projects, funded how? Which conferences? Which events? With whom do they co-publish? With whom do they share projects? Where do they visit? Use their model for ideas and insights.

Keys to success

If you study role models, you'll find that international researchers have qualities in common:

- **Quality:** as a wise colleague once phrased it, 'Do damned good work, and tell a damned good story'.
- **Visibility:** not just doing good research – but also joining the discourse; engaging in the community.
- **Passion:** you need to really want to do it.
- **Vision:** identify your territory, and have a coherent story about your work 'as a body'.
- **Collaboration:** work with excellent people who motivate you and extend your knowledge and thinking.
- **Honesty:** you can't win long-term any other way: saying 'I can't this time' won't stop the next invitation, saying 'I don't know' and then responding intelligently lends authority.
- **KISS (Keep It Simple, Stupid):** don't try to do everything at once; one good work leads to another.

Cultivate your personal research agenda

Choose the right area for you. It needs to be something that really interests you, or even better, inspires you – you're looking at the long term. Then, it needs to be an 'open' topic that hasn't peaked yet, something acceptable to mainstream conferences but with a small research population. (Hybrid and cross-disciplinary topics are often good for this.) Identify your territory. Identify a variety of issues/questions within it that interest you. Choose sub-topics that accumulate to contribute to a 'bigger picture'. Maintain a coherent story about your work as a whole.

Ask yourself before you start any new work: how does this contribute to my agenda? Identify short-term targets and waypoints that serve your agenda. Identify publication targets of international calibre that serve your agenda. Remember that 'science (or other research) proceeds by baby steps'.

Work 'smart'

You can't do everything. Working hard is a pre-requisite, but working even more or even harder won't always be the answer, because you are a finite resource. Instead, choose high-yield activities that serve your agenda.

- Learn to say 'no'.
- Target international conferences and journals and make the best possible use of your material.
- Find out who the 'gatekeepers' are, and figure out what rules they follow.
- Publish iteratively, advancing from small conference papers to cumulative journal papers, and building up a body of material.
- Re-use concepts: use components like ideas, theories, and literature reviews for different purposes (e.g. turn grant proposals into papers, and vice versa) and re-cast material for different audiences (e.g. an empirical study of requirements elicitation can be reported with a requirements engineering focus, or with an empirical studies of software development focus). An important skill is to learn the difference between this and 'self-plagiarism'. If you re-use material for which you've already assigned copyright to a third party, such as the journal publishing the article containing that material, you can get into horrible legal problems. If in doubt, ask someone knowledgeable.
- Only accept invitations if they are strategic. That goes for talks, publications, collaborations, refereeing, and so on. You needn't do everything you're asked to do, just because you're invited. Consider whether the invited contribution will further your agenda, or whether it has a role in making you visible and valuable in a research community – or whether it's just more work without particular strategic benefit to you. Focus on the invitations that serve your agenda.

Join the community

- Be visible: get out and talk to people.
- Give seminars at relevant institutions, making sure that you have appointments for individual conversations afterwards with the key researchers there. Follow up on particular interests with email or other conversations.
- Join the programme committee for a key conference. Subsequently, referee for a key journal. Eventually, join the journal's editorial board.
- Host a workshop or tutorial. Invite key researchers and make sure you find opportunities to talk to them.
- Do good work in public. Ask good questions at conferences. Make constructive suggestions in 'birds of a feather' sessions (i.e. informal discussions at conferences based on a shared interest).
- Be a 'good citizen': be fastidious about citing other people's work and giving credit. This may include sharing links to papers, or 'retweeting' posts online with the correct attribution. Pass on references to other people's work in discussions; when appropriate, follow up by sending links to relevant papers. Keep your promises. This sort of activity establishes you as a useful, knowledgeable 'good egg'.

Collaborate with excellent people

Accumulate a broad network of contacts – research acquaintances that you might contact on particular topics or with whom you might correspond. Invite

relevant researchers to connect with you through your professional social media profile, as appropriate (we discuss social media in detail in Chapter 5). Select a core network of 'advisers' – research colleagues you trust and respect, who are knowledgeable, and with whom to exchange manuscripts and explore work-in-progress, including early ideas. Seek contacts and collaborators outside your department, outside your university and outside your country. Don't limit yourself to academic researchers in your area: look for industry contacts and collaborators, for interesting thinkers in other domains. Concentrate on the excellent ones, and on people with whom you get along comfortably.

Making contacts, even international contacts, isn't hard, if you've practised networking as part of your PhD (see Chapter 5). International conferences and research visits are good ways to identify like-minded researchers and build relationships. Various funders offer overseas travel grants to promote collaboration. Even without travel funding, you can connect and correspond with other researchers about their work through the Internet. Scan the appropriate fora, blogs, discussion lists, journals, conference proceedings, and newsletters in order to keep track of who's active and influential in your community.

How to join a programme committee

For many conferences, this is a gradual process: you start with a small role, and then move into a larger one. In effect, you're asking to join a particular community, so you need to engage with the community and show that you can contribute to it. Go to the conference. Attend the 'business meeting' or 'feedback session' and make constructive suggestions. Meet members of the current programme committee and express interest. Follow up on those meetings with an email confirming your interest. If you are asked to review papers, then do a good job (write objective, constructive, informative reviews that identify virtues of papers as well as deficiencies), and do it on time.

Maintain an appropriate online profile

Your online presence may focus on a personal web page, or include a number of profiles in online social networks such as LinkedIn or ResearchGate (among many others). When choosing online social networks, remember to distinguish between open-source, non-profit organisations associated with .edu domains and for-profit companies that may exploit or monetize the information provided. If you have more than one research profile online, they should all be consistent, even if the content is tailored to the format and audience. And you may choose to link between them.

Make sure that your agenda is evident and stated with enthusiasm. Use an attractive, upbeat photo on your homepage. Include useful things, like a good annotated bibliography in your area, or some neat software, or a compilation of specialist research techniques, or up-to-date pointers to other relevant websites. Keep your online profile current, and review and update it regularly (but not too regularly). Appropriate content may include your academic or

professional appointments, roles and responsibilities, conference and journal article links, any relevant academic accomplishments, honours or awards. Present yourself as open to introductions, conversations and connections.

Effective researchers separate their research profiles from any personal profiles – and treat their research profiles with more care and caution. Think before you post. Your online profile needs to reflect judgement, professionalism, competence, integrity. Ideally, it should also reflect excitement and passion for your research.

You may consider posting or blogging about your research to increase its 'discoverability' online. This should be done with care and thought about what you put into the public domain, as once 'out there' it will remain so forever. We discuss the dangers and opportunities of posting in greater detail in Chapter 5. You should also be mindful of how such online activities can suck up time.

Chapter 4

Supervision and project management

• The role of the supervisor • The role of the student, or managing expectations • Getting the most from supervisory meetings • Effective debate • Establishing a good relationship • Prevention is better than cure • Cardinal rules • Strategies for when things go wrong • Project management

When you become a PhD student, you embark on what is likely to be an intense relationship, both personally and professionally, with your supervisor(s); for simplicity, we'll refer to 'the supervisor' in the singular from now on, but the same principles apply to a supervisory team. It's likely to be different from your previous academic relationships, because as a research student you'll take up much more of your supervisor's attention and time. You can't hide among the other students the way you could on a taught course; you're a visible individual as a PhD student.

Similarly, your supervisor is going to be a lot more important to you than your undergraduate project supervisor, when your project was only one part of your course.

A good relationship between student and supervisor needs work by both parties. It isn't your supervisor's responsibility to make everything all right; it's up to both of you to work together. Many doctoral students encounter unnecessary problems because they make classic mistakes in dealing with their supervisors. Unfortunately, our experience is that most students don't think this relationship through, and that most supervision problems are predictable and preventable. So, it's time to start thinking things through . . . then you will be much more likely to be viewed as an asset to your supervisor and the department, and to finish with a happy ending.

Most PhD horror stories have their origins in the supervisory relationship rather than in the research topic or the external examiner. The most common cause is that the student didn't take the supervisor's advice. Less common, though not unknown, is horror due to an incompetent supervisor. The current trend is for PhDs to be supervised by more than one supervisor, which reduces the risk; in addition, departments normally pay keen attention to students' performance at stages such as transfer, where incompetence is usually spotted and subsequently investigated.

The relationship between student and supervisor can be as intense as many marriages, and lasts as long as many marriages. It's a fairly good analogy in several ways. One important issue is compatibility. You can't expect that your relationship will be straightforward with every potential supervisor you might meet. Likewise, it's not your supervisor's job to put up with every unpleasant idiosyncrasy of every idiot who wants to do a PhD with them. As a student, you are an apprentice, not a customer who is always right.

Also on the subject of rightness, there isn't a single type of 'right' student or 'right' supervisor, any more than there is a single type of 'right' partner. There are various types of supervisor, and various types of student; each type of supervisor will be well suited to some types of student, and less well suited to other types of student. At this point, the marriage analogy starts to become somewhat strained. In the old days, a high proportion of students signed up to do a PhD with a specific supervisor. Now, it's increasingly common for students to sign up with a department, and then to be assigned a supervisor or, more often, a supervisory team.

A closer analogy for this situation is two or three survivors shipwrecked on a desert island and having to learn not just to get along with each other but also to work constructively together, regardless of whether they would have chosen each other as companions if they had had a choice. Sitting on the beach complaining that the other survivors aren't perfect human beings isn't going to get a fire lit; similarly, sitting at your desk expecting your supervisor to be perfect isn't going to get your dissertation written.

You have to make the most of what you've got, unless the situation is completely pathological (discussed in more detail below). Note that this is an active process, not a passive one; you don't simply put up with the situation that you first encounter, but instead you identify the resources you've got and then put them to the best use you can. With this in mind, it's a good idea to assess your personality and your needs as a student, so that you can assess what you would like from your supervisor and how to set about obtaining those things in a way which suits you both. Relevant factors usually include your need for technical support; your need for emotional support; your need for guidance and structure in planning the work; your ability to handle criticism; and your ability to deliver on time, to the agreed standard.

It's also a good idea to ask yourself which of your characteristics (a) will make you awkward for anyone to supervise and (b) are likely to lead to problems with a particular type of supervisor. You should then think about which of these things you are willing to improve and what the implications are for how you approach your supervisor and your PhD.

The role of the supervisor

A fruitful area for misunderstanding involves what services supervisors are supposed to provide. Students seldom think about this.

One common misconception is that the supervisor is a purely technical resource, there to provide expertise in (for instance) the obscure area of Unix programming that you are studying for your PhD. Students with this misconception typically encounter problems when their supervisor doesn't have the answer to an obscure technical question. Such students typically complain loudly that the supervisor is incompetent, and then wonder why they receive so little sympathy from the department. The purpose of the PhD is to demonstrate that you can operate as an independent researcher and uncover new knowledge; if you expect your supervisor to know more than you about every aspect of your PhD, then you have missed the whole point (which is for you to become the expert on your topic).

There are many different ways to supervise a PhD, and many different roles which a supervisor can have. Each student is different and will require different support. At one extreme is the student who can be pretty much left to get on with it, with supervisory meetings being something that both parties enjoy, and where each party learns from the other. This is rare, but it does happen. Such students don't always have brilliant academic grades from their first degree. What they tend to have in common is a willingness to learn for themselves and good judgement about when to stop and ask for feedback. At the other extreme is the student who doesn't take the initiative about anything, who needs constant feedback and active encouragement, and who appears to expect a worrying degree of spoon-feeding. For students at the willing end of the spectrum, supervisors will often be very busy behind the scenes, trying to find funding for the student after they graduate; for students at the needy end of the spectrum, the supervisor may have different priorities.

The minimum supervisory role involves filling in the relevant forms as you progress through The System, writing annual reports, liaising with the organisation where you are doing your fieldwork, and so on. Beyond that, there are numerous possible roles, which may or may not be relevant to your case, and which will probably be invisible to you.

Other roles include:

- **Specific technical support:** for instance, skills training in using the library or specialist software; pointers to relevant literature; providing contacts with other researchers; guidance on structuring the thesis; training in critical reading
- **Broader intellectual support:** for instance, helping you develop skills in discussion and critical thinking; providing high-level knowledge about the field and about research issues in the field; providing specialist expertise in conducting studies in the field
- **Administrative support:** for instance, finding funds; finding other resources; protecting you from political and administrative difficulties within the institution; publicising your work

- **Management:** for instance, providing a structure (meetings, deadlines, goals); deadline creation and enforcement; project management
- **Personal support:** for instance, career advice, emotional support and counselling.

If you're feeling cynical about this, it's worth remembering that the student's performance reflects on the supervisor who has to undergo, among other things, institutional procedures and reports (including scrutiny of PhD failure rates); supervisors' meetings; peer scrutiny at transfer/probation assessment; research assessment exercises; and scrutiny from funding bodies.

Why do people become supervisors? It's certainly not for the money, as supervision is almost never remunerated. And it's not for release from other tasks, since workload planning almost always underestimates the time supervision takes. There are many reasons, ranging from a direct order from the head of department, via a feeling of duty, on through mercenary self-interest (such as using the students to further the supervisor's career), to idealism and a love of working with students.

Whatever the supervisor's motivation, it's in both your interests to get along. Whatever the moral rights and wrongs of a particular issue, it's very much in your interests to make the relationship work; failing your PhD is a greater disaster for you than it is for your supervisor, so expecting your supervisor to do all the running in your relationship is not an advisable strategy. It is, as usual, a good idea to try seeing things from their perspective. If you were asked to supervise an undergraduate project, what sort of student would you want to supervise and what sort would you not want to supervise at any cost? Once you've thought about that for a while, try looking long and hard at your own behaviour from that point of view: how often have you missed a meeting, turned up late, turned up unprepared, expected your supervisor to do all the thinking, and so forth?

You are ultimately responsible for your work; your supervisor is not. Taking your share of responsibility in the supervisory relationship is good practice for the dissertation and viva, where the burden is on the student to communicate – if the thesis is unclear to the examiner, it's the student's problem, not the examiner's. So practise on your supervisor. Decide what you want from the PhD and from the individual meetings, and communicate this to your supervisor.

As with marriage, it's worth putting the effort in, because the relationship is likely to last at least three years, and a good supervisory relationship will benefit you for the rest of your career. Also as with marriages, it can be useful at times to remember that supervisors are human too – they'll have bad days and human failings. Be realistic and forgiving in your expectations, and the chances of a happy ending for you both are much better.

Avoid behaviours that suggest unreasonable expectations

Students have classic ways of sabotaging supervision and irritating supervisors:

- Failing to take deadlines seriously
- Failing to respect the supervisor's time pressures (you are but one demand among many)
- Dumping demands on the supervisor at the last minute instead of allowing them time for reading, thinking, enquiring, etc.
- Expecting the supervisor to read every draft, usually by the next day
- Expecting the supervisor to organise everything
- Organising things without consulting the supervisor (independence is good up to a point, but you need to check you're being independent in the right way).

The role of the student, or managing expectations

You may think that the student's role is simply to get a PhD. The reality, however, is somewhat different. The student's *goal* is to get a PhD, and in pursuit of that the student has a number of *roles*: keen apprentice, contributing member of a research community, junior employee of an institution, and so on. Strangely enough, your PhD is not just 'about you'; it's also about your supervisor, your department, your university. It's not all take – you have to give, too.

Whatever your expectations about your PhD, others have expectations, too. It's worth finding out what they are. Some of them have to do with meeting your contractual obligations: attending specified training sessions, completing forms on time, showing up in the office, etc. Some of them have to do with behaving sensibly, such as attending meetings on time, keeping your supervisor informed, and being aware of ethical issues. Some have to do with engaging with the research environment, including attending research group meetings, attending research training, and attending seminars by external speakers. Some have to do with taking an active role in your research community, such as talking to other researchers, trading favours (like reading each other's papers), and offering moral support. Some of them have to do with making it worth your supervisor's investment: showing enthusiasm, being responsive, bringing ideas and evidence to the table, following through, and so on. There's usually a student handbook and code of practice that gives some clues about expectations, but nothing beats a frank conversation with your supervisor.

Expectations arise from many sources: regulations, cultural background, experience, academic cultures (at institution, department and group levels), personalities. That's a lot to un-pick. At least the expectations embodied in the regulations are explicit. Academic cultures can often be observed – which is a good reason to engage with the research environment and take an active role in your research community. We suggested earlier that you reflect on your personal characteristics and expectations that may affect the supervisory relationship. But sometimes cultural expectations are ingrained and implicit, making them harder to expose. It may seem obvious that international students may struggle to understand behavioural expectations – but differences in culture may apply equally to part-time students coming from industry, who often

struggle with the transition to academic culture. Some of the typical stumbling points have to do with 'polite behaviour' or 'appropriate discourse'.

Polite behaviour

Students from different backgrounds may have very different expectations of the student–supervisor relationship. There are many ways discrepancies of expectation show up: in attitudes to deference and respect, in the willingness to question or challenge, in attitudes to what constitutes 'offence', in the willingness to take initiative, in the ability to ask for what is needed. A PhD is a demonstration of the skills and knowledge needed for independent research – including the ability to think for oneself, to question, to challenge, to propose. Hence, one of the first skill assessments we do with our own students is: can the student answer back? This can be problematic for students coming from 'respect cultures', for whom this may constitute disrespect, and who may therefore need to be reassured that intellectual challenge is an expectation, not an offense, and may need to be taught how to make polite challenges based on explicit justification. Calibration of what constitutes 'polite behaviour' can come from that frank conversation with a supervisor, or with a wise independent party in the department, or with a student from a similar culture who has already come to terms with local expectations.

Appropriate discourse

Similarly, students from different backgrounds may have different expectations of 'appropriate discourse': how (and how much) to collaborate; how to present an argument effectively; how to use evidence; how to express those intellectual challenges or critiques politely, effectively, impersonally. Different contexts use different forms of expression and demand different levels of rigour and different types of evidence – this is a large part of what this book is about.

It is worth pointing out that supervisors, too, come from different cultures and backgrounds, and have different expectations. Supervisors, too, can have preconceptions at odds with those of colleagues or with local norms. So, negotiating and aligning expectations is a skill that extends beyond the supervisory relationship, and the process of gently probing expectations, aligning the expectations of the team, and making expectations explicit can streamline and facilitate communication.

Getting the most from supervisory meetings

As usual, try looking at it from the other person's point of view – most of the answers will then become pretty obvious. Supervisors are research-active academics, and research-active academics are hideously overworked. PhD students take up time, which is the supervisor's scarcest resource, and are in that

sense a liability. A sensible student will reduce their liability rating; a good student will find ways of being a positive asset.

Reducing the liability rating mainly involves basic professional courtesies. It's your PhD, not the supervisors'; if you can't be bothered to work on making it happen, why should they? Making it happen includes making supervision meetings work: you should take the initiative in setting up the meetings, circulating relevant information in advance, drafting an agenda, and coming with a clear set of things to report and questions to ask. Something which is easily overlooked is that you should also take accurate notes of the meeting, recording decisions and actions, and circulate those minutes afterwards, then check that the actions are in fact taken. Many organisations require students to keep logs of meetings for The System. Table 4.1 at the end of the chapter summarises tips for effective supervision meetings.

There are different types of meeting, suitable for different purposes. PhDs also require informal meetings when you explore ideas or discuss your longer-term career plans, or work through a problem that is bothering you. (These usually take place over the legendary cup of coffee, often with chocolate biscuits.)

Insight after the event

There is a delayed-realisation effect that beleaguers many a supervisory discussion. Often, students leave supervisory meetings and *then* make sense of the supervisor's point, or what their reply should have been, or which question they should have asked, or what they wished they'd said instead of what they did say.

That's what email was invented for. Take the time to write down the delayed insight, preferably clearly, and send it to your supervisor promptly.

Effective debate

Too many students sit silently when they should speak up. Some supervisors (including us) find this infuriating; they like students who can answer back and defend their position. After all, that's what they'll need to do in order to defend their thesis.

Debate thrives in an atmosphere of respect. Too many students are too ready to say: 'My supervisor is an idiot', or 'I don't want to do it that way'. They're usually wrong, often because their vision is clouded by their arrogance. If your supervisor critiques your ideas or opposes your proposal, there's probably a reason. Rather than drawing harsh conclusions about your supervisor's intellectual ability, it's safer to assume that your supervisor knows something you don't, or has experience that you don't, or is looking from a perspective that's obscure to you. It's your job to elicit that knowledge, experience or perspective. It's also worth remembering that the supervisor is criticising your ideas or proposal, not criticising you: that's a very important difference.

On the other hand, students from cultures with deeply ingrained values about respect for elders are often reluctant to question or challenge. In the

West, telling your supervisor your ideas, and showing your understanding of your supervisor's ideas through discussion, is actually a form of respect. It shows that you're doing your job, meeting your responsibilities, respecting your supervisor's time, and offering your own intellectual investment.

Debate thrives on evidence. Do your homework and marshal your evidence. Be prepared to make claims or suggestions and to back them up. Follow up conjectures or proposals with 'because' statements: 'I think we should check the reliability of the instrument, because our readings are all over the place'; 'I think we should restructure the framework, because the new structure does away with an unused category and clarifies a useful distinction'; 'I would rather not rely on Bloggs, because his study is deeply flawed in the following ways'; 'I think we should get someone else involved in the discussion, because I need to hear it in different words'. Then be prepared to analyse and critique your ideas and the evidence on which they're based – and possibly to alter them or to let them go.

You are not the same thing as your ideas. Understand that, when your supervisor probes or questions an idea, that constitutes engagement with the idea – not a personal attack on your intellect. Feel the compliment.

Ask questions. 'The only stupid question is the one you didn't ask.' Most misunderstandings arise from miscommunication – and from unexplored assumptions. Human beings have developed all sorts of glosses and shortcuts that help them to think quickly – useful when facing immediate danger like a saber-tooth tiger, but sometimes problematic in a supervisory discussion. Asking questions about what things mean, underlying reasons and apparent assumptions can be the key to insight: yours about the subject, or your supervisor's about your thinking.

Ask a question, rather than making a statement. One of the skills of effective debate is to learn non-aggressive forms of speech. Rather than making an outright challenge, ask for clarification or explanation. This can save you profound embarrassment when you discover that you're the one with the erroneous assumptions or misconceptions. Instead of 'What idiot thought that germs could heal?', try 'Why would someone think that germs could be a way to cure?' Instead of 'That doesn't make sense', try 'Why does that make sense?' Develop a repertoire of elicitative forms of speech: 'Can you show me an example?'; 'Why this and not that?'; 'May I repeat that back to you?'; 'I'm not sure I've understood accurately . . .'

Managing the supervisory relationship and offering effective debate are how you stay 'in the driver's seat'.

Establishing a good relationship

There are various strategies which students can use to make life better for all parties in the PhD, but which are not as widely used as they should be. These include:

- Exchanging favours, such as tracking down an obscure reference for your supervisor in exchange for some advice about a job application (but make sure that the exchange is agreed explicitly, so you both know where you stand)

- Showing passion and enthusiasm
- Showing explicitly that you value your supervisor's knowledge and experience
- Trying to do something the supervisor's way, but setting criteria and a date for evaluation of the success of it (especially if you're reluctant)
- Not just refusing to do something you don't like, but offering an alternative instead
- Being scrupulous about giving credit where credit is due (e.g. when you publish papers)
- Finding out about your supervisor's research – surprisingly few students do this, even though their supervisor's research is probably one of the most valuable resources available
- Allowing your supervisor to be human – tolerating human weaknesses and making the most of your supervisor's strengths.

What to contribute

The supervisory relationship is two-way; you are supposed to be actively learning, not passively waiting to be told all the answers.

At the most academic level, you should be actively finding things out and actively generating ideas. One sign that you're doing a proper PhD is that you're finding out things which are new to your supervisor; another is that your supervisor finds at least one of your ideas sufficiently interesting to merit genuine engagement and discussion. It's useful as well as courteous to give your supervisor a *précis* of what you've found, and to offer full copies of any material that the supervisor would like to read in more detail.

At the implementation level, you should be generating ideas about specific research questions to ask and specific research methods to investigate them. You should be doing this increasingly as the PhD progresses, and you learn more. Your supervisor will probably advise against most of these ideas; what you need to do is to assess the reasons for this advice, rather than going into a corner and sulking. One thing which most students never consider is that a good supervisor will be generating ideas about their own research all the time, and discarding the vast majority of them on various grounds. If you expect to have a higher hit rate than your supervisor while you're still an apprentice, then you're being a bit silly.

At the motivation level, you should be generating passion and enthusiasm. If you're bored, that will make your supervisor bored too; give them a reason to look forward to your next meeting instead of planning an escape to Acapulco.

What to ask for

There are various things that you should ask for, with appropriate courtesy, at various stages of your PhD.

From an early stage, you should ask for appropriate training, both in research methods relevant to your research and also in other areas which will help you – for instance, many students would benefit from assertiveness training

and relaxation training, as well as time management and numerous other ancillary skills. You should ask specifically for skills advice if you need it (e.g. what is the form of a conference paper?; how does one read a paper and make notes about it?). It's particularly helpful if the supervisor can work through an example with you, rather than just telling you how to do it. A lot of students are embarrassed to ask for this sort of advice on the grounds that they think they should already know it. That's a faulty assumption. The point of the PhD is that it's about learning these skills; if you had them already, there wouldn't be much point in doing the PhD.

When you're at a later stage and have some findings to discuss, you can ask your supervisor to recommend (or introduce you to) other experts who might help. This needs to be done with discretion. Your supervisor will probably not introduce you to someone who will steal and publish your ideas (a frequent source of generally unfounded nightmares for PhD students), but you do need to have enough knowledge of academic etiquette to handle such encounters properly.

What to tell your supervisor

You should keep your supervisor informed about:

- The state of your work
- What interests you and what concerns you
- Outside opinion: report feedback from talks and papers accurately and promptly; be specific about both compliments and criticisms
- Decisions and turning points: the supervisor can often provide helpful insight and forestall hasty misjudgements
- Life circumstances: let your supervisor know about personal or practical matters that are affecting your work, preferably before they turn into a major issue. You don't need to go into details; phrasings such as 'problems in my personal life' are usually suitable.

Things you can do for yourself

There are also various things you can do for yourself. You should keep your supervisor briefed about all of these, in advance. This is partly common courtesy and partly practical self-interest (so that the supervisor can stop you if you're about to do something remarkably stupid on your own initiative).

One thing worth doing is to assemble an informal 'committee' of people (both staff and students, both in the department and external) who are able and willing to help with your PhD. The key thing to remember is that this is to complement your supervisor, not as an alternative to your supervisor. The informal committee can be helpful for things ranging from low-level logistics (e.g. babysitting) and low-level practical skills (e.g. learning how to use your computer properly) up to general emotional support and specific academic

advice on topics complementing your supervisor's advice (e.g. help translating foreign language articles about your area of research, or specialist advice about statistics).

Another thing you can do is to give seminars and/or circulate draft papers (again, with your supervisor's approval). This both gives you experience and provides you with feedback.

Destructive behaviours to avoid

People do stupid, suicidal things in stressful situations, such as PhDs. Here are some of the most destructive.

- Hiding (yourself, or real or imagined problems)
- Ignoring (advice you don't understand; advice you don't like)
- Mixing (business with pleasure or with personal issues)
- Gossiping (about your supervisor or colleagues)
- Denigrating (your supervisor, department or institution)
- Bypassing (your supervisor, by making decisions without due consultation)
- Assuming (what something meant; what you're entitled to do)
- Sinning (illegal or unethical acts – much more serious than the failings listed above).

In our experience, all students hide at some time or other. So keep an eye on yourself: do you really need to postpone your supervision meeting again to give you that third week to write that pesky paragraph, or would you be better off admitting that you're stuck and asking for help?

If in doubt, ask. This is particularly important in relation to assuming and sinning. Students often don't check that they really understand something that they're not quite sure about, and then end up with serious misunderstandings and serious problems. Similarly, students often have mistaken understandings of what is considered reasonable; for instance, is it reasonable or not to phone your supervisor at home without explicit prior agreement? Illegal acts are usually fairly easy to identify, but unethical ones may require much more knowledge. For instance, thanking respondents by name in the acknowledgements section may be intended as a sign of genuine appreciation, but may breach their anonymity and lead to significant professional and legal problems. Commercial sensitivity is another problematic area, as is publication of draft material. If in doubt, ask . . .

Prevention is better than cure

In any relationship which lasts as long as a PhD, and which involves learning new skills and exposing one's ego and intellect to scrutiny, something will

inevitably go wrong. The key questions are what that thing will be and what you're going to do about it.

Most difficulties in the supervisory relationship are 'cock-ups' rather than 'conspiracies'. Always start from the assumption that all parties are acting in good faith. As is often the case, prevention is the best cure: if you have good work habits (e.g. networking effectively, keeping good records, letting other people know what you're working on, publishing internal and external reports promptly, communicating clearly and promptly), then many difficulties can be avoided altogether. Good habits will also make early diagnosis easier. Good communication can usually sort problems out before they become serious.

A classic example is dealing with the supervisor who is never available. Make friends with the administrators who know your supervisor's schedule, and make sure your supervision meetings are on that schedule. Discuss the problem with your supervisor. Explain your needs. You may not be able to reduce the travel schedule of an international expert, but you can probably work out means for remote communication, so you can still get advice when your supervisor is away. Use your informal committee to fill in when your supervisor is otherwise occupied – and keep your supervisor informed about developments.

A tactful conversation can make an enormous amount of difference in helping you negotiate a tricky situation such as a personality clash or a misunderstanding – whether it is a tactful conversation with your supervisor or with a wise colleague (for instance, a cup of coffee with someone discreet who can give you some suggestions about how to address your concerns with your supervisor). Assertiveness training can also help prevent some situations arising, for example if you feel uncomfortable defending your ideas or resolving conflicting opinions. However, whilst it is acceptable for your supervisor to ask uncomfortable questions about your research, it is never acceptable for your supervisor to make you feel personally uncomfortable or, at worst, unsafe.

Cardinal rules

In brief, there are a few cardinal rules about dealing with your supervisor. They should be blindingly obvious, but a surprising number of students seem to need to be reminded of them.

- Be honest
- Be articulate (say what you mean and ask for what you need)
- Be informative (keep the supervisor informed)
- Be respectful (remember, your supervisor holds that academic position for a reason, even if the reason is obscure to you, and you're asking for your supervisor's time and input)
- Be adult (i.e. take responsibility for yourself).

Strategies for when things go wrong

If you are convinced that you have the wrong supervisor, and you can articulate exactly what quality or problem is irredeemably fatal to the supervisory relationship, then you'll need to find a new supervisor. It's crucial that you find the replacement before rocking the boat, otherwise you'll destroy the relationship you have, and you'll have ruined your reputation with everyone else. The point is to find a better match, not to throw verbal rocks at your present supervisor. So find positive reasons for the change (a different research specialism, better personality fit). The more diplomatically you handle the transition, the better it will be for you and for everyone else involved.

There are some classic problems that are usually fatal to the supervisory relationship, sometimes immediately, sometimes late in the PhD, when change is most difficult. These are in a different league to the inevitable misunderstandings, arguments, disagreements and such like that occur in any PhD.

The really serious problems include the following.

- **'isms:** sexism, racism, anti-Semitism, etc. Most institutions have procedures for dealing with this. Whether or not you want to become embroiled in formal procedures, you should find a new supervisor.
- **Intellectual Property issues:** 'absorption' or theft of work, obstruction of research, suppression of results. Good habits (like letting people know what you're working on, writing up results promptly) can help here, but sometimes they are not enough.
- **Non-communication:** when no matter what you try, you can't get through.
- **Harassment:** sexual harassment, bullying, damaging insensitivity. Again, most institutions have procedures for dealing with this, or at least a trained person to help you deal with it.

If you find yourself in any of the above situations, you must proceed with extreme care and diplomacy. You will need to:

1. Find out exactly how supervision is coordinated in your department; there will be a procedure for changing supervisor. The bottom line is that, once it has accepted you, the university has an obligation to find someone to supervise you. There may be a bullying and harassment policy which is applicable. Go about this investigation discreetly.
2. Establish the paper trail: write things down, keep all emails, etc. Write down the facts, with dates and details, as dispassionately as you can. If there really is a problem, the facts will speak for themselves.
3. Consult a third party, confidentially. There is often a designated third party, a 'third-party monitor' (whose job it is to review the progress of the supervisory relationship), a postgraduate tutor (who oversees all research student supervision), a professor or director of research, an equal opportunities officer, a research dean. Sometimes there is an accessible Wise Person in the

department, often one of the professors, someone who has been around and knows the ropes and who is kind and sympathetic. Sometimes it will be easier to speak to someone outside your department. In any case, choose an academic who is experienced and respected as well as compassionate. Speak as calmly and dispassionately as you can, bring along your documentation, ask for advice and listen.

4 Call in a third party (not necessarily the same one that you consult for advice). It may be appropriate to ask someone – usually someone senior – to act on your behalf. This person can sit in on your supervision, in order to see what's going on, can intervene with your supervisor or can help you through the procedures. Choose your third party carefully and listen to the advice this person gives you.

Project management

The counterpoint to 'managing your supervisor' is managing yourself and your project. One of us was counselling a part-time PhD student who was running out of time. (Are you aware of your university's regulations about maximum registration?) Upon hearing the suggestion that he needed to project-manage the remaining few months of his PhD, he laughed sharply and said: 'That's ironic; do you know what I do for a living?' The laughter acknowledged the penny dropping; it hadn't occurred to him earlier that his PhD was a project to manage, rather than an opportunistic journey of uncertain destination. As soon as he brought his professional skills as a project manager to bear, his progress improved and he submitted in time.

If you think of your PhD as a journey, then one version of the management challenge is that you see the destination on the far horizon, but you can't really see how to get there. Another version is that you can see a path, but the destination is far away and out of focus. The essence of project management is not to 'choose a path and stick to it', but to keep a clear eye on the destination and continually re-assess the route in terms of available time and resources. This insight, and indeed the overview of project management in this section, was provided over coffee by a wise colleague, David Bowers.

The essence of project management

- Where are you heading?
- What do you (really) need to do to get there?
- What has to be done first?
- How long will it all take?
- Where are the failure opportunities?
- How much is still unknown?
- Do you have time for diversions?

Scope and success criteria

Instead of imagining the ultimate destination and assuming that anything is possible and resources are unlimited, project management means understanding the constraints of time and resources – in order to scope the destination and prioritise tasks that are instrumental to reaching that destination. It's a balance between the goal and the practicalities. Striving to solve a global challenge is fine, but the reality is that a PhD is a time-limited process, which typically demands focusing down to a useful sub-challenge. Instead of expecting to reach that distant mountain peak, it may be enough to reach a significant waypoint *en route* that gives a better view of the destination and of the path ahead. Start with core ideas, and leave the elaboration to future research.

The notion of 'scoping' your research comes back to the first steps in research design: asking what you want to know, and how you might know it. What evidence is sufficient to provide compelling insight? In other words, you need to know the *success criteria*: the standards by which the research will be judged at the end to decide whether or not it contributes to knowledge. You need to define what success looks like, in order to plan how to achieve it within your resources.

Time

John Wakeford, of the Missenden Centre, does an eye-opening time-calculation exercise:

1 Start from the submission date: assess the actual time available in number of days.
2 Make realistic allowances for personal leave, illness and other 'interruptions'.
3 Make realistic allowances for training, conferences, teaching experience, job applications and other 'related tasks'.
4 Allow for contingencies (25%?).

Most people are shocked by the amount of time left. So think realistically, and plan accordingly.

Project management has a happy partner: time management. Time management is about using the available time well. There are lots of nice books, blogs and tools to help with time management; the key is to find a repertoire of techniques that work for you. If one way of structuring your time (e.g. planning the day as a series of time slots) doesn't work for you, try another (e.g. planning for the week, with the days as the units – an admin day, a research day, etc.) – and be prepared to try different approaches in different contexts. But traditional time management isn't enough when the job (i.e. PhD) involves too much unpredictable firefighting (i.e. dealing with serious immediate unexpected problems) – that's why you need project management, to help prioritise and adjust.

Managing the side-tracks

It's all very well to talk about planning, but research involves surprise and opportunity, too. Those can look more exciting in the moment than your planned research. Good project management considers them – and adjusts when appropriate. There are some basic questions that help determine the difference between an opportunity and a side-track:

- **Will it definitely add value?** Do you know that it will succeed? What's the risk if it fails? How soon will you know?
- **What's the impact on your primary path?** How many things could still go wrong? What happens when the results are mixed/negative/contradictory? Can you really afford to digress before you are sure that the previous bit of work is sound?
- **Does it matter?** Or are you just looking for 'displacement research'?

Good project management is flexible and can adjust when there is value in doing so; but it reminds you to look before you leap.

Dangers

Many factors can threaten your progress:

- Undefined success criteria: failure to understand 'what matters' and what the standards are
- Undefined scope: lack of planning at the outset, lack of clarity about the 'destination', failure to identify the goals and objectives along the way
- Scope creep: too many uncontrolled changes
- Schedule creep: not enough contingency, not enough management, 'elastic scheduling'
- Distraction and digression
- Reducing complexity before understanding it – leaving underlying problems or key elements unresolved
- Failure to anticipate problems
- Assumed skills – that take time to acquire
- Unrealistic assumptions: 'we'll take as long as it takes'
- Unrealistic optimism about how long things take.

Beware of the dangers; you'll meet them. If you're alert, you can manage them enough to reach your destination.

Table 4.1 A simple scheme for effective supervision meetings

Check the agenda with your supervisor(s)	Several days before the meeting, find out what your supervisor(s) want to get out of the meeting. Agree an agenda. Check the actions from the last meeting – have they been done? Remind people of the time and place of the meeting.
Provide a discussion document	Send something to your supervisor(s) a week before the meeting (this can be a progress report, a study plan, a critique of the literature you've been reading, an annotated bibliography, data, a draft conference paper – whatever represents what you're working on). Having something concrete to discuss always helps, and preparing something can be a good way to focus your thinking. Bring copies to the meeting.
Provide key publications	Send copies of papers you consider to be seminal to your supervisor(s) in advance of the meeting, particularly if you wish to discuss them. Ask your supervisor(s) if they prefer electronic or hard copies. Make sure the full citation is marked on the copy. Providing papers is a courtesy you can do your supervisor(s), and having them on hand can facilitate discussion.
Show up on time	Somebody wise once told us that it is not endearing or bohemian or cool to always be a bit late; it's just plain rude. Sadly, sometimes it's unavoidable. If you are late, bring chocolate.
Write down your objectives	Know what you want to get out of the meeting, whether it's technical, administrative or emotional. Give yourself a prioritised checklist in advance. It helps to have something interesting to discuss when you enter the meeting – if you don't have ideas, then prepare questions.

(continued)

Table 4.1 (continued)

Behave well	• Listen and consider before you speak. • Be prepared to give a candid account of your progress. • Ask stupid questions – they may seem stupid to you, but they rarely are. • Focus on ideas, not emotions; trust your supervisor(s) and don't take things personally. • Make counter-proposals if you don't like what your supervisor(s) are advising because this can help expose discrepancies in your thinking and help you understand the rationale for the guidance.
Take notes	*Always* take notes! Record actions since the last meeting, any decisions made, any actions agreed – including waypoints, deliverables and deadlines.
Book the next meeting	Set a date for your next meeting before you leave and set a preliminary agenda.
Email an action-item summary	Immediately after the meeting, write a list of agreed action items (both yours and those of your supervisor(s)), with deadlines if possible, and email it to all concerned, asking for confirmation that you've summarised correctly. Include the date of the next meeting.

Chapter 5

Networks and networking

• Building a network • Tools for networking • First contact – cold calls • Social media • Opportunities via social media • People you should remember to include in your network

Contrary to a widespread belief among the general public and among depressed second-year PhD students, you don't complete a PhD in gloomy isolation. There are lots of people who help you, not just through your doctoral research, but also throughout your subsequent career; and there are more who can help you, if you find them. This network won't be confined to eminent academics who are noted experts. It will more usefully also include lesser mortals whom you find good for conversations, who are good readers and commentators, who may have insight into theories, literatures and methodologies with which you are less familiar, who themselves have good networks and are happy to introduce you to useful people, who understand The System, and so on. Some students have good networks; others don't. This chapter describes networks and how to create a good one for yourself.

One common misconception is that networks involve cliques of people doing morally dubious favours for each other, at the expense of more virtuous but less well-connected ordinary people. That's only one type of network. We're using the term in the different sense of normal, ethical support networks and normal, ethical professional networks – people you know and can turn to for advice.

Building a network

Networks don't just happen; they're something you build, whether consciously or without thinking about it. Even if you're normally good at building networks without conscious effort, PhD networks will, by definition, be new to

you, so it's worth knowing about a network structure which most students find useful.

At the heart of your network, of course, are your supervisors.

A second important component of your network is your informal 'committee' (i.e. people who will help you to ensure that your research is of good quality). For this, you need a small set of reliable, interested academics who are willing to do some work for you: to read, to comment, to advise, to critique, to provide pointers, to introduce you to other researchers, and so on. They may be specialists who can provide particular expertise, or they may be generalists who can ask incisive questions.

A third main component is your personal support network (i.e. people who give you encouragement and moral support, who help you manage your work, keep life in perspective and bring you pizza when you're in the throes of inspiration). They may be family, or fellow students, or old friends. They may be academics in your department who are good at bringing you to your senses.

In addition, you need people who can be called on occasionally for specialist help, or people you can visit once or twice to pick their brains. They may be leading researchers in your specialist field, or they may be technical experts who know about things like laboratory instruments, running databases and formatting documents.

Targeting

Most networking is opportunistic: if you meet someone that you happen to like, or find a useful contact, then you stay in touch with them. Sometimes, however, you need to find particular kinds of help or expertise, and for that you need a strategy. Three particularly useful starting points are:

- The writers of particularly relevant papers.
- People you saw or met at a conference who had pertinent and interesting things to say.
- People recommended by someone reliable (e.g. your supervisor, or a member of your informal committee).

Once you've identified some possible leads, you need to do some initial work and then make contact. The initial work consists of some homework. There's a reason why you've identified this person as someone to contact, but don't forget to find out what else you can about the person before you make contact, since there may be other ways in which they can help you. It also makes the contact easier if you know something about the person you're contacting. Here are some things you can do:

- Google them; check their website.
- Ask people who know them.

- Check with the person's admin staff about when would be a good time to call, and whether the person is in the country.

An essential bit of preparation is to consider what it is that you want to ask them. It's not enough to say that you're working in the same area as they are – they might justifiably react to this news by thinking, 'So what?' You need to say whether you want to clarify something about their work, or want a chance to discuss ideas, or want them to review your work. The more focused and informed the question you ask, the better the chances of things going well. Remember that anyone with enough stature to be worth approaching is probably also approached by other students. A surprising number of these students will ask vague, lazy questions which amount to: 'Can you tell me everything I need for my literature review, to save me the effort of finding it out for myself?' This is why we stress the need for tact and courtesy when asking someone for an overview of something over a cup of coffee – there's a world of difference between a cup of coffee with a well-read, hard-working student and a cup of coffee with an ignorant, idle one.

It's usually easier to make contact with people who are local, because it's feasible to 'just drop by' their office and take them to coffee. However, just because they're local, that doesn't guarantee that they're available or friendly; you still have to do the homework first. On the flip side, people who aren't local often respond well to a quick video call (Skype or something similar), if you can make yourself available at their convenience (including any time zone accommodation) and have done your homework. You can't offer coffee, but you can offer a smiling face and an interesting conversation.

Tools for networking

Two of the main time-honoured tools for networking are shameless flattery and bribery. Shameless flattery usually takes the form of shameless flattery; bribery usually takes the form of coffee, chocolate biscuits and practical favours such as unearthing obscure references. (Just in case of misunderstanding, real bribery via monetary or sexual favours is unethical and illegal, and we emphatically disapprove of it.) Table 5.1 at the end of the chapter gives tools and tips for networking.

Flattery

The secret of effective flattery is that it is barefaced, precise, economical and accurate. That is, it has to flow easily and openly from the flatterer, it has to relate specifically and accurately to the flatteree, you mustn't overdo it and it must bear some relation to reality. One well-informed, well-placed compliment on a recent publication will do more good than ten vague generalities. It also reduces the risk of your compliment being mistaken for the opening line in a seduction attempt or sexual harassment.

Coffee

Eminent people are human too, and at venues such as conferences they can be very glad of a break and a decent cup of coffee paid for by someone else. Coffee can be used in various ways. One is as the setting for unofficial advice of one sort or another – career prospects, organisational politics, the future of a research field. Another is as a chance to unwind a bit at a gruelling conference or similar occasion. Treating someone to a cup of decent coffee as a break from a long admin session can be a real act of kindness, especially if you behave with tact and consideration during the coffee (for instance, by not talking about work, if your guest wants to get away from it for a while).

Chocolate biscuits

These are a surprisingly useful incentive. If you offer someone some cash to be a subject in your experiment, it might motivate them to some extent. If you offer them an upmarket chocolate biscuit and real coffee, then this is likely to motivate them considerably more, and make them more cooperative and friendly into the bargain. There is a literature on the reasons for this (it involves 'currencies', 'strokes', and 'judgement and decision-making', if you feel inclined to follow it up).

Not many people believe in the efficacy of chocolate biscuits, which is probably just as well, because if everyone adopted this approach it would devalue the currency, and the shrewd researcher would need to find a different incentive (which would be a double annoyance to those researchers who happen to like upmarket chocolate biscuits).

Trading favours

People are busy. Interesting people are often very busy. One way to borrow some of their precious time is to offer them an exchange – to do something of value for them which allows them to free some time for you. For example, you could offer to do some administrative work or library searching in exchange for half an hour of discussion over coffee (you still buy the coffee).

First contact – cold calls

'Cold calls' (contacting someone who doesn't know you) outside your own institution can be awkward both for the caller and the person being called. It's hard to establish the basis for a conversation in a sentence or two, but you can make it easier if you prepare in advance. Cold calls can succeed if you can establish quickly that the exchange can be of mutual benefit. So think through in advance what you want, and what you have to offer in exchange.

Your best chance is to establish an immediate connection with the person you're contacting (e.g. through an introduction by a mutual acquaintance such as your supervisor or through reference to that person's publications). Having made that link, you need to say who you are and what you want.

Smart researchers like students with interesting ideas, and so they generally respond well to them, especially ones who have potential as named candidates on future grant applications. But sometimes active researchers already have as much work as they can handle, so you shouldn't assume that they'll have time for you – or that a lack of response necessarily means a lack of interest.

Be prepared to follow up your initial contact with some substance, for example a good, one-page *précis* of your research or a well-constructed conference paper reporting some of your early findings. Make sure what you send represents you well: ensure that it is clearly written, free of major and minor errors, and clear it with your supervisors and other experienced readers first.

Via email

Published researchers, especially well-known ones, are inundated with requests from random research students wanting favours. Requests that run 'Dear Professor Haagen, I am a graduate student in Budapest researching ice cream and I wonder if you could offer me any advice about a choice of research topic' are tediously uninformative and suggest that the student, being incompetent, is not worth the bother of answering. On the other hand, concise requests that give substantive information about the student's research and ask specific questions are far more interesting and usually attract a response, though perhaps not an immediate one. It might well take the researcher six months to find time to read your message, decide to think about it, lose it in the crush of work, and eventually find it again and reply. Maybe the researcher won't reply but will remember a good message when you meet at a conference and introduce yourself. Think about it from their point of view: if you had 50 emails about a research bid with a budget of several million pounds, and a deadline next Tuesday, would you defer answering them until you'd read every word of an email from a PhD student you'd never heard of before? If anything, it's surprising how many positive responses you can get to a well-constructed cold call.

If the researcher does reply to your message, be sure to send a thank-you message immediately. If you have a good *brief* summary of your research, or of a piece of it, then you might attach it to the follow-up message.

We have deliberately not included examples of good cold call emails, since we don't particularly want to be lynched by eminent colleagues who receive large numbers of identically worded requests for help, but here are some things to think about:

- Did you get their title right, and spell their name correctly?
- Does your question show that you've done some homework?
- Does your mentor/supervisor think that your question looks interesting?
- How long would it take a reasonable human being to write a reply to your question? (If it's more than ten minutes, then consider rephrasing the question.)
- Is your message so long that it scrolls off the page when the addressee opens it? (If so, shorten it.)
- Does the message show you in a good light, as someone who can spell, write clearly, think, and generate interesting questions?

- Does the message offer them anything (e.g. access to data), and if so, can you deliver on that promise?

At a meeting or conference

Have something interesting and relevant ready to say. A compliment is handy, but be prepared to follow it up with a question, otherwise the conversation will die. (Even the most eminent researchers can be embarrassed by compliments, especially if they're too gratuitous.) It's best to have a question prepared that invites a multi-word response: for instance, 'Professor Katz, I was intrigued by your paper in *Nature* on semi-stochastic systems. I wondered whether you had tried applying that approach to trade networks?'

Use the opportunities that the meeting provides. If your person asks a good question during a session, you might catch them after the session and remark on the question and its implications. If you see your person talking to someone you know, you might ask the person you know to introduce you. If you see your person in a loosely arranged group, you might stand visibly on the periphery until you get a chance to make a contribution (a short question or a joke is good) or ask if you may join the group. A good time to catch people is as a session breaks up, before they've found their way to coffee or lunch. But don't keep them from refreshment – offer to walk with them.

Have a business card to hand, and perhaps a copy of a brief summary of your research (previously read and approved by your supervisor).

Don't assume that you are beneath notice, or, worse, beneath interest. Here are some home truths about Great Researchers to help you put them in perspective.

- They are usually great because they love ideas and asking questions – so they usually have an appetite for nifty ideas and good questions
- They are usually just as susceptible to deft flattery as the rest of us
- They were once research students and many of them still remember that.

Social media

There are plenty of reasons for using social media tools in the research discourse. Minocha and Petre[1] identified six functions that researchers address with social media and other technologies:

1 *Formal dialogues with team members*, e.g. email, web-based conferencing tools such as Skype, a project wiki (posting regular updates), telephone or conference calls

1 Minocha, S. and Petre, M. (2012) Vitae Innovate Handbook of Social Media for Researchers and Supervisors. Available at: https://www.vitae.ac.uk/vitae-publications/reports/innovate-open-university-social-media-handbook-vitae-2012.pdf/view.

2 *Informal interactions with peers, team members and broader research community*, e.g. Google chat, Skype, Slack, Facebook (for updates), Twitter (for disseminating news), SMS texts (for quick updates or queries), telephone conversations
3 *Documentation* – authoring exchange of documents with team members and document storage, e.g. email, cloud platforms such as Dropbox, wikis or blogs (often protected), bibliographic referencing systems such as Mendeley, Zotero, Qiqqa
4 *Space for reflection* – working with ideas and the process, e.g. blogs and wikis (as a research journal), content or document management tools such as Drupal or DEVONthink (research journal), diagramming tools such as OmniGraffle, or mind-mapping software
5 *Engaging with the community at large*, e.g. a profile on Academia.edu and/or on LinkedIn (connecting posting updates, linking up with Twitter feed), Twitter (posting updates), blogs (exposing research thinking and findings), SlideShare (for sharing presentation materials), YouTube (sharing methods and findings) and Scoop.it or Paper.li (curating content)
6 *Keeping informed about resources, conference news, funding calls*, e.g. mailing lists, Twitter, blogs, iTunesU, Ted Talks, YouTube videos, technology sections of online newspapers, groups and pages on Facebook, discussions groups on LinkedIn.

The tools will change with time. But the enduring message is fitness-for-purpose: leveraging the right social media tools in the right ways to meet specific goals (i.e. discerning instrumental behaviour). That means considering the nature of the social presence you want to achieve, the intended audience, how often you expect to engage, resources, and return-on-investment.

There are also plenty of obvious reasons for thinking carefully about how you use social media. A popular genre in social media is 'What were they thinking?' humour, often involving pictures from Myspace, a once-popular but now almost forgotten social media site. The irony of a current trend in social media that involves mocking earlier trends in social media hasn't escaped everyone.

Most students are now well aware of issues such as employers having a quick look at applicants' social media posts as part of due diligence on their background. There are plenty of people who have suffered severe damage to their career because they posted something unwise which went viral and came back to bite them. What's posted online stays online, and is available for scrutiny by anyone (from trolls to government agencies) with the tools and interest; online presence is never truly private, and sometimes there are painful consequences of imprudent behaviour (security and privacy breaches, identity theft, online bullying, disclosure of embarrassing personal information, and so on).

Note that most researchers separate their online researcher and personal identities strictly, and most part-time students separate their researcher and professional identities as well.

Accidentally stumbling into trouble

We'll discuss a few of the less obvious problems with social media briefly before returning to the positive aspects.

At one level, anything that you do on social media might turn into trouble one day. That can, ironically, include not doing anything on social media, which could one day be perceived as failing to stand up and be counted about a major moral issue. A naïve or demoralised response to this point is to give up on concepts like tact, sensitivity and sense, on the dodgy grounds that if you're going to upset somebody anyway, you might as well treat the world to the benefit of your unfiltered opinions.

A better response is to treat this issue in much the same way as any other risk: identify potential risks, then prevent or avoid them where possible, minimise their effect if you can't avoid them, and then have strategies for managing any problems that do hit, and for clearing up afterwards. The next subsections give some examples of how to do this.

Unsuspected sensitivities

There are plenty of examples of people blundering into unexpected sensitivities. Anything cross-cultural is a rich source of easy misunderstandings. One common form is behaviour that is perceived as disrespectful by the local community, such as clowning around in a location that has religious or historical significance. Some such locations, such as temples and churches, are easy to spot as significant. Others are not so easy. There's no obvious way of spotting that this mountain is viewed as sacred among the local community, while the one next to it is viewed as just another hill.

Even if you're behaving in a sober, respectful way, it's easy to stumble into sensitive areas with something as apparently simple as the wording you use. Tagging a photo as being of Anasazi ruins or of a Macedonian village, for example, takes you into cultural and political issues that are deep, complex and often the source of heated debate.

You can prevent or avoid many such issues by doing some homework before you post (and preferably before you go to the location). This also helps with managing any problems that do arise; you're in a much better starting position if it's clear that you've shown sensitivity elsewhere, so your apology will have a much better chance of being believed and accepted.

True Believers and sealions

True Believers in this context refers to people with an obsessive belief in a pet theory. That theory may involve religion, but usually it doesn't. Here's a hypothetical example, using a fictitious topic so that we don't end up suffering from the problem that we're describing.

Suppose you've just posted a blog article about social changes during the Industrial Revolution brought about by new technology, such as Jenkins'

Twizzler. The Twizzler is just a random example that you mention in passing. Suddenly, you get an irate comment from someone who believes that Jenkins stole the idea of the Twizzler from his assistant Blenkinsop.

If you're lucky, the commenter will go away after making his/her point. If you're unlucky, the commenter will set up camp in your comments section, going on and on and on about how you're complicit in Jenkins' theft, even in articles that have nothing to do with Jenkins or the Twizzler. This behaviour has been labelled 'sealioning' in some online communities, after a cartoon involving sealions that move into someone's house and then make everything about themselves. If you're really unlucky, the original commenter will be joined by fellow believers, and your online life will become challenging.

This is where your professional and social support networks can make a big difference. They can help you maintain your sense of proportion, especially if the True Believers are trying to gaslight you. They can also give practical advice about how best to handle the situation, which can be very useful if you haven't encountered this sort of behaviour before.

Looking like a True Believer

The converse issue involves behaving as if you yourself are a True Believer. This is surprisingly easy to do if you're a new researcher, full of energy and desire to make the world a better place. If you come across an amazing new idea, there's a real risk that you'll be seduced by it, and feel the need to go on at length about it to everyone you've ever met, and to a lot of people online who have never had the misfortune to meet you previously.

At the time, it feels like spreading The Truth. After a while, though, the initial euphoria may wear off, as you start to spot the limitations of the apparently amazing idea, and slowly begin to realise why it hasn't already taken over the world. At that point, you could start feeling very silly indeed.

So, if an idea looks too good to be true, then take your time and test it thoroughly. The usual cup of coffee with someone knowledgeable is a wise use of time at this point. If the idea still looks good, you can then think about posting it with some careful phrasing, so that you're writing about this idea, as opposed to this idea in which I believe completely and utterly. That enables you to change your position gracefully in the future, if you discover that there's a fatal flaw in that shiny idea.

Looking naïve and silly

It's possible to present yourself in a way that you later regret even if you're writing about something well established and uncontroversial. A classic example is the enthusiastic but woefully uninformed online article by someone who has just encountered a well-established concept for the first time, such as evidence-based approaches, or hypothesis testing, or social constructivism.

Well-established concepts have usually undergone a lot of critical examination at the hands of experienced and sophisticated researchers. If you rush into an excited description of evidence-based approaches or whatever without first reading the critical literature, you will look like a classic beginner, in a way that can provide entertainment to unkind colleagues for a long time to come.

You can avoid or reduce this risk by simply including the word 'critique' in a quick online search about the concept in question. For instance, a search for *critique evidence-based approaches* will find a lot of useful articles about the limitations of these approaches, which will help you to produce a much more sophisticated and nuanced post.

Opportunities via social media

On a more positive note, although there are risks with social media, there are also opportunities.

Social support and technical support via social media

PhDs are usually stressful, in terms both of your personal life and the technical issues you encounter in the PhD itself. Social media can be invaluable in both these areas. There are many online support groups and online resources for PhD students, including, for example, groups for students trying to juggle the PhD with parenthood or illness. There is also a lot of support for obscure problems with technology, or methodology, or facts. If you want to find out why your bibliographic software isn't formatting the way you expected, or to find a less horrible way of doing content analysis, or find a library with the second edition of a particular book, then social media really come into their own, such as helping you find an ally in someone else who is also dealing with that software or who's found that book.

Consuming social media

Social media can also be invaluable for keeping you updated on events, and as a source of information that you might never have thought to look for. This can include sources of professional and personal support, as well as interesting insights, resources, news, and so on.

But 'reader beware': consumption must be critical, because social media can be profoundly biased and overwhelming. The whole point of the research discourse is scrutiny and debate based on evidence; social media does not maintain the same standards, and mis-information and biases can spread. It's up to the reader to focus on credible sources and to look for relevant supporting evidence rather than accepting opinion. Check and read the references underpinning a claim, not just the headlines; this is an indicator of your critical development as a researcher.

Producing social media

Posting online can help fellow researchers and fellow students, and can give you a chance to practise writing, and a way to network. There's plenty of online advice about this, so we won't go into detail about the nuts and bolts.

It's wise to lurk before posting, preferably until you've seen some examples of problems arising for other people, and also seen some examples of how people handle those problems. This reduces the risk of looking like a clueless amateur when you start posting, because you'll already have seen enough clueless amateurs to know what to avoid. It will also improve your chances of looking like someone who is a valued member of the online community, because you'll have seen enough of those rare but wonderful creatures to know how to become like them.

It's also wise to think before posting. Take a pause between composition and commitment. Have someone sensible read your material before you post it. Prevention is easier than recovery; 'if in doubt, don't'.

People you should remember to include in your network

Most of the section above refers to contacting researchers about research. There are other categories of very useful people that it's easy to overlook, so we've included a short section about them here.

Mentors

Mentors are Wise People who take an interest in your personal, professional and intellectual development. They're the people who teach you the 'unwritten rules' and who can see the 'bigger picture'. In theory, your supervisor should be a mentor, but it doesn't always work out that way. A mentor is a more experienced researcher who will show you the ropes from this perspective of success and informedness. A mentor can show you the things you don't know how to look for. This is particularly useful for the things that you don't *know* that you need to look for or do, such as getting the right things on your CV as early as possible – a friend won't always know what the right things are, and some of the right things are counterintuitive.

Secretaries and other support staff

Always treat support staff – secretaries, technical support, custodians of facilities – with respect. *Never* underestimate their value. *Never* confuse salary level with worth. Support staff are the keepers and collators of useful information – they are the ones holding together the department, they are the providers of services and assistance, they are often the gatekeepers to things you need. Consider: if you really wanted to know the inside story about government policy, would you ask the prime minister or the civil service? Journalists know all about this, and successful journalists always get on well with the secretaries of the people they investigate.

Wonderful People

One invaluable resource is Wonderful People. There are a few people who have invaluable skills such as improbably excellent social or professional contacts, or encyclopaedic knowledge of one or more literatures, and who are helpful and pleasant. Such people should be cherished and appreciated. As a new researcher, you will probably not know any people fitting this description (or more probably, not realise that you know them). When you do start meeting them, treat them well; they should be declared living national treasures. Librarians and secretaries are also often wonderful, and friendships with them are almost always well worth cultivating.

Table 5.1 Useful tips for networking

Aim to be genuinely nice to people	It makes the world a better place and it pays off in the long term – people will remember you and put things your way. This is not the same as being silly or a victim, or as being mercenary.
A cup of coffee with a knowledgeable, supportive person can be the best investment you ever make	Asking advice from the right person at the right time (usually before you get started) can save you a lot of tears and a lot of wasted effort. Remember to ask someone knowledgeable about the relevant area – a fellow lost soul, or someone knowledgeable about a different area, may be comforting but is unlikely to be much help in getting you out of the problem.
If you have any choice at all, only work with nice people whom you respect	You achieve much more this way and you have a nicer time along the way.
If you don't know what you're doing, then stop and find out	Another cup of coffee can help at this point.
Do good work in public	Ask good questions at conferences. Socialise and mingle. Make constructive suggestions in 'birds of a feather' sessions. Phrase commentary as questions rather than statements.
Trade favours	Don't just ask for things – offer useful services in return. One way to borrow time from busy people is to offer them an exchange – to do something of value for them which allows them to free some time for you. Engage in constructive forms of 'you scratch my back; I'll scratch yours': swap papers with other researchers, participate in each other's studies, help each other with reliability tests, and so on.
Be a 'good citizen'	Like it or not, you're a member of a research community, and it helps if you pay tax. Offer a bit of your time to contribute to that community: sitting on appropriate committees, reading other people's papers, helping to organise selected research events, exchanging leads with other researchers, inviting and looking after seminar speakers, etc. Keep it under control, but the occasional bit of strategic volunteering can introduce you to interesting and helpful people, increase your exposure in the community and generally encourage people to think of you as a 'good egg'.
Use social media prudently	Remember that what goes online, stays online. Think before you post. Think fitness-for-purpose: consider the nature of the social presence you want to achieve, the intended audience, how often you expect to engage, resources and return-on-investment – then choose your tools and channels carefully.
Follow up	Carry the dialogue on past the conference or initial contact. Keep track of who you meet, where you meet them and what their interests are. Keep your promises; send the citations or copies of papers that you offered to send. Email other leads that you think might be of interest.

Chapter 6

Reading and sense-making

• Why read? • The need to read critically • Finding the right references: where do I start? • Review articles • Not all resources are created equal • Online searching • Other sources of information • 'Sniffing' a paper • When have I read enough? • Organising the literature • Using material from the literature • Keeping an annotated bibliography • Enjoy reading

PhD students are painfully aware that doing a PhD involves doing a lot of reading, and that doing a lot of reading is hard work. By the time you're a few weeks into a PhD, you'll also be worrying about how to decide what to read. There's an enormous amount of material out there, far too much for any human being to read in a lifetime: how do you know which parts of it to read and which parts to ignore? What happens if the examiner in your viva starts asking about a literature that you've never heard of, let alone read, but which sounds horribly like something that has fatal implications for the thesis that you've spent years assembling? Where do you start with your reading, how do you decide where to go with it and how do you know where to stop? That's what this chapter is about.

We have included a fair amount of detail about how to search for relevant literature. If you're going to be a good professional researcher, you need to be aware of the differences between sources of various kinds and able to use the tools of your trade efficiently and well. Few students are strong in this area (although many believe they are), but it's a valuable skill that will both improve the quality of your work and save you effort.

Why read?

Why does doing a PhD involve so much reading? Because reading is the road to mastery: it's how you come to acquire and understand existing knowledge and existing techniques; it's how you come to know the research community; it's how you come to understand the tools of your trade. So, while you're reading, you're doing a number of things, including:

- **Mastering the literature:** discovering what has been discussed and what hasn't, what is known and what isn't, what the major strands of thinking are and how they have evolved
- **Mapping the community:** identifying who the key researchers are and how they interrelate
- **Identifying your niche:** finding the gap that you hope to fill, understanding its relationship to the rest of the literature and identifying the publications most relevant to your project.

Students' use of the literature usually matures and focuses during the course of their research in a way that corresponds to the development of their research question. The development goes through several phases, as shown in Table 6.1.

The researcher's core literature

One tool that established researchers have is a working knowledge of the relevant literature. Most established researchers have a core repertoire of 100 to 150 works on which they can draw readily. (Of course, there's huge variation, but the numbers don't really matter – the idea of keeping a selection of pertinent

Table 6.1 Development of students' use of literature

Entering student	Later student	Still later student	Completing student
Knows which research area	Knows which research topic	Knows what research question	Knows what research evidence
Reads to find what's already known	Reads to clarify	Reads to fill gaps	Reads to know what isn't already known
Surveys, collects, reports	Organises information	Selects information relevant to research question	Judges information (quality and gaps)
Wonders how to organise sources	Wonders how to identify problem	Wonders what has already been said about the problem	Wonders what has not been said about the problem

literature accessible in memory does.) These are a useful selection from the hundreds or thousands of articles and books the researcher has digested over time. The repertoire gives a researcher a context in which to place ideas: the collection characterises the major strands of thinking in the field, identifies the major researchers and provides research models and examples. Of course, the repertoire evolves and must be updated. As researchers continue to read, the core adjusts, shifting to follow developments in the discipline – and importantly to follow a researcher's changing interests and developing critical perspective. But some of that core will persist for years. One of the things a good doctoral student will accomplish is to amass a first 'core' literature (and to identify key researchers and thought leaders).

Reading a lot

You need to read a lot. You need to read a lot in your own discipline (so that you have a thorough grasp of what it is all about) and in other disciplines, both apparently relevant and apparently irrelevant. Much of the best work comes from cross-fertilisation between apparently unconnected fields. Table 6.4 (at the end of the chapter) summarises tips from successful people who read a lot about how they manage to do it.

In your own field, you should read in depth and in breadth and in *time* – you should have a detailed knowledge of the relevant literature in your chosen area, and a general knowledge of the main work in related areas, and of previous work in your area for as far back as possible. A good strategy is to read from the present to identify the current themes and thinking – and then to trace those back to key classic texts and theories. For your own area, you should be reading everything up to and including the most specialised journal articles. For other areas, you might find book chapters a more appropriate level (though be careful about the level of the book – don't even think about popular books for the lay public, and be wary of textbooks unless they are prestigious ones).

The need to read critically

At the heart of academia lies The Literature, like mounds of ancient treasure in a vast deep cavern piled high with glittering gold collected over untold ages by countless adventurers and miners and the occasional dragon. Priceless gems of wisdom lie among honest coins and cheap bracelets and the occasional gilded fake crown and cursed sigil. There's untold wealth in there, but also a lot of grot that you really don't want to have anything to do with. During your PhD and your career afterwards, you'll have to venture into that cavern, and try to tell the gems from the glass, and the gold from the gilded. As you may have guessed from this extended simile, or may already know, telling the difference is not always easy.

When you're an undergraduate, the description of The Literature that you are given goes something like this:

> *Researchers produce articles about their research. They submit their articles to places such as conferences and journals, which then assess the quality of those articles via peer review. The higher the quality of the article, the higher the quality of the place where it is published. The peer review system has its flaws, but overall, you can be reasonably confident that an article in a top quality journal will be a top quality article. No article is perfect, and no peer review is perfect, but the higher the status of the place of publication, the smaller the flaws in an article will be. There are occasional glitches in the system, such as fraudulent publications that manage to get past peer review, but those are so rare that you don't need to worry about them.*

It's a nice, comforting model. The world would be a much better place if it were true. Unfortunately, the reality is somewhat different. There are plenty of problems with the literature, and they are distributed generously across disciplines. In management theory, for instance, there were increasingly open questions about whether the landmark Hawthorne study actually happened quite the way that it was usually reported. In social anthropology, there were similar murmurings about Margaret Meade's high-profile work on adolescence in Samoa. The understanding of 'scientific understanding' (in its broadest sense) changes over time.

The issue spilled out into the open with the growth of approaches such as meta-analysis, in which you look for patterns across multiple pieces of research on the same topic. These approaches depend on being able to assess the quality of each piece of research, so you can decide how much weight you give to its findings relative to other pieces of research on the same topic, particularly when those pieces of research reach different conclusions. There's a world of difference in credibility between someone posting their findings on their own website and someone publishing results in *Science* or *Nature*, for instance.

When John Ioannides started looking systematically at patterns in the literature, he found that much of the literature was unreliable, even in high-status journal articles by prestigious authors. The short version of what happened next is that this led to The Replication Crisis, where researchers in a range of disciplines tried replicating classic findings from their literatures. The results, as you may have guessed from the name, were not encouraging. As a rough approximation, about half of the articles checked couldn't be replicated; in other words, their findings couldn't be reproduced.

Quite why this situation arose, and how it should be remedied, are questions outside the scope of this book. Researchers familiar with target-driven economies, such as Stalin-era bureaucracies, tend to view this problem with the wry smiles of those who predicted this sort of outcome right from the start of target-driven research assessment exercises, which produce system pressures towards inflated claims and towards high quantities of low-quality outputs. Researchers familiar with research craft skills tend to have similar expressions.

The implication is that you need to treat the literature with caution. When you know what to look for, you can get a fairly good idea of which findings are solid, and which are wobbly. The 'what to look for' part, however, isn't about how prestigious the place of publication is, or where the researchers are based. It's more about things like being able to read between the lines in the methods section and the results section, and about doing a quick small-scale replication test of your own before getting into a full study design.

One's ability to read critically develops over time, with practice. A good way to develop this skill is to read as though you're reviewing, identifying the publication's strengths and weaknesses, and deciding whether or not you would rely on its findings or recommend others to read it.

Literature surveys versus literature reviews

Students typically begin by surveying the literature, and gradually learn to review it. As one colleague phrases it, they go from reading to discover 'what's there' to reading to discover 'what isn't there'. The difference between a literature *survey* and a literature *review* is the difference between report and critique. A report just lists things which the report writer considered worth listing. A review says what happened, and why, and how, and also says why the review has focused on the issues it did and why it treated other issues as less important. Ideally, the completing student should have developed a *critical voice*. The literature review in the dissertation should *make sense* of the literature in terms of the thesis. If the literature review is well-structured and appropriately critical, then, ultimately, the research question emerges as a logical conclusion of the literature review.

There's also a difference between the sort of 'stand-alone' literature review published in a journal and the literature review that frames a thesis (see Table 6.2). The difference relates to the purpose of each: the former should provide an accurate overview of and introduction to the subject literature (and typically 'add value' by structuring it, critiquing it or providing an insightful perspective on it); the latter serves the thesis, providing a frame and focus for the research question.

Table 6.2 Contrast between a 'stand-alone' literature review and the review that frames a thesis

Stand-alone literature review	Review of the literature to frame a PhD thesis
Maps the field for a specific topic	Frames the research question
Ends with a clear structure and critical analysis	Uses critical analysis to frame the research question
Broad	Like a funnel: may start broadly, but focuses down to the research question

Literature reviews versus meta-reviews

A difference in purpose also distinguishes the sort of 'systematic review of the literature' that frames the thesis from a meta-review (i.e. 'Systematic Literature Review' or SLR), which compiles and analyses the data from previously published studies. Both have value – and both require that you understand what characterises a quality review – but they have different purposes (see Table 6.3). The literature review provides an overview of the current state of knowledge; the meta-review compiles and analyses published evidence related to a specific research question.

One must be aware of the limitations of any of these formats. A good literature review should represent the current 'state of knowledge' on the topic, including the different (and potentially competing) strands of thought. It should be representative, but it may not be comprehensive, given the 'explosion' of publications in the modern world and the constraints of a single PhD, so there is always a danger of significant omissions. A meta-review must be carefully and concretely focused, and use a highly systematised set of procedures to search the literature for evidence relevant to precise questions. The need for precise questions implies that the approach is not suitable for an initial literature review, when the student is trying to hone in on an appropriate research question. The SLR concept is sensible, and when it's used on the right set of literature to ask the right types of question by someone with the right expertise, it's a very powerful method. However, that combination of circumstances is rare, and often the very procedures which are intended to provide rigour exclude relevant literature (that doesn't meet the inclusion criteria, e.g. qualitative studies) and hence introduce bias.

For starters, there's the question of whether the literature is trustworthy in the first place (cf. the replication crisis).

There's also the issue of which types of question you can use, and which particular questions you ask. Often, the most difficult and important part of research is working out what the key question actually is; once you have finally identified the right question, finding the answer is frequently straightforward. To work out what the key question is, you'll have to wade patiently through the literature, following clues from one reference to another, until you finally reach that glorious moment when you realise what the real problem actually is. SLRs can't help you with that; they're designed to answer

Table 6.3 Contrast between a systematic review of the literature that frames a thesis, and a Systematic Literature Review (SLR) or meta-review

Systematic review of the literature to frame a PhD thesis	Systematic Literature Review (SLR) or meta-review
Ends with the question	Starts from a precise question
Broad	Focused
Builds understanding	Requires clear understanding

specific well-defined narrow questions, not to help you find out what the real underlying issue is. The SLR methodology does include an initial stage usually known as a mapping study, which is intended to address this issue, but in our experience the mapping study tends to be viewed as a straightforward issue to be got out of the way before doing the SLR, rather than as a major issue in its own right.

In addition, to conduct an SLR properly, you need to know how to assess the quality of each study that you include in the review. As the replication crisis showed, you can't simply take it for granted that there's a simple mapping between the prestige of the journal where an article is published, the prestige of the institution where the authors work, and how much you can trust the findings of that article. To do a proper assessment of quality, you need to have a deep understanding of research design, research methods, and statistics – at least as good an understanding as the authors whose work you're assessing. That's a big ask.

The real risk with SLRs is that they're good at producing plausible-looking results via a systematic approach. However, *plausible* isn't the same as *true*. When plausible but wrong findings appear in a journal article, they can do serious damage to a field; for example, by claiming that an approach doesn't work, when in fact it does work, or vice versa. So, if you're going to use an SLR, you should be sure that your understanding of research design, research methods and statistics is better than that of the authors whose work you're assessing, and you should also be sure that you're applying the SLR to the correct question in the first place. If that's the case, there's plenty of online guidance about the protocols to follow for conducting an SLR.

The message overall is to understand the purpose for which you're reading and reporting literature, and to be critical, vigilant and responsible in how you achieve that purpose.

Finding the right references: where do I start?

So, where is a good place to start looking for references? Some students have a fair idea already because of writing their PhD proposal; others are taking up a studentship to work on a topic which has already been outlined by someone else (such as their supervisor). The easiest solution if you're unsure where to start reading is to ask your supervisor, politely, where to start. Your supervisor should be able to signpost other leading figures in the area, and is likely to remind you about literature reviews in the papers you've already read, about review articles and about the literature reviews in passed dissertations in your area. You may also be pointed towards some online searching, with keywords either supplied by your supervisor or included in the articles which you have already found.

You also need to develop an understanding of where researchers in your discipline publish. What are the key publishers, book series, journals, conferences, symposia, workshops or meetings? One way to find out is to ask your

supervisor. Another is to identify a couple of researchers (such as your supervisor) whose work you respect, and investigate where they publish, and what events they attend (much of this information will be on their websites, in one form or another). In addition, find out if there are any important mailing lists, bulletin boards, or blogs in your area, as any of those are likely to provide leads.

If your supervisor doesn't know, ask someone else, politely, and keep your supervisor informed, in case you start blundering in where angels fear to tread. You need to send out the signal that you're a hard-working individual who will make good use of the advice, rather than an idle brute who can't be bothered to do their own research (mentioning what you've already read and asking where you should go next is a good start). Your supervisor can be invaluable here.

If you're lucky and virtuous, your supervisor might say something along the lines of, 'The person to talk to about this is X; I've emailed X, who is happy to give you some guidance. Here's X's email address.' This is an encouraging sign and is academic shorthand for the following things:

- Here is something which will save you a lot of effort
- Here is a chance to make contact with a major player in this area
- I trust you enough to let you speak to important players in this area by yourself.

It does *not* mean, 'I am too ignorant or idle to provide guidance on this by myself'. If your supervisor offers you this opportunity, then grab it with both hands and do some intelligent preparation before you meet or contact the person in question, so you don't look clueless – find out more about the person and their research, and do at least some background reading beforehand, so you don't look as if you're asking them to do your literature review for you; the rest of this chapter should help with this process.

Cynical supervisors have been known to give students explicit advice about which sources to read, but not quote, as an initial overview so that they understand the area. Alleged examples range from *How to Lie with Statistics* (almost certainly true) to *The Ladybird Book of Computers* (surprisingly, perhaps true to some extent).

Review articles

Review articles are an invaluable source of information. These are articles which summarise developments in a field, usually over the previous 10 or 20 years. They're typically written by people who are extremely knowledgeable about the field and they identify key issues and key papers in that field during that period. They're an excellent way of finding the key references to start your work; those key references will usually include references for earlier literature reviews, allowing you to work back through the years. They're also invaluable as supporting references for some key points which may otherwise be very awkward. For instance, if a review article says that there hasn't been enough

work on a particular topic and you're doing your PhD on that topic, then the review article gives you an authoritative justification for your choice. Without that reference you'd have to make the claim yourself that there hadn't been enough previous work, and that's a difficult claim to substantiate without a very solid knowledge of the field, which a new PhD student is unlikely to have. But take care: citing a review article (i.e. a secondary source) is rarely enough; if it contains key insights that you intend to use, then you should also read the primary sources from which they derive.

Not all resources are created equal

Academics deal with knowledge and information and should know how to find, interpret and present knowledge and information. An important part of this is finding the best possible sources, so that your assessment of the problem in question is based on the best information and knowledge available. Not all publications demand a rigorous argument, or a robust evidence base, or a theoretical underpinning, or peer review. The academic literature has a pecking order, ranging from publications which are accepted on sufferance through to publications which are treated with considerable respect. Some of this pecking order is quite possibly based on snobbery, but most of it is based on the quality control that the publication uses. The more rigorous the quality control that a publication uses, the more prestigious the publication is. It's a simple and sensible concept, and it makes life a lot simpler and more reliable for everyone involved. If you're about to spend months or years of your life – and perhaps sizeable amounts of money – researching a topic, then it's very reassuring to know that your initial assumptions are as solidly based as they can be.

Anything submitted to a top-quality academic journal for publication will normally be checked in detail by several leading international researchers on the topic before being accepted for publication. Anything which is not of suitable quality will be rejected. Further down the pecking order come the middle-range journals, which also use refereeing, but which normally use less eminent referees. Towards the bottom of the scale come specialist newsletters and professional trade magazines, where articles may be reviewed by the editor rather than specialist referees.

The precise status of a publication will be affected by individual factors; for instance, some specialist newsletters will be edited by eminent authorities, have high-level contributions, and be higher in the pecking order than some journals. Books are also very variable in their status. As a fair rule of thumb, textbooks are low in the pecking order, because they usually present simplified accounts for students (although they can provide an introduction to a topic unfamiliar to you and a useful bibliography). Specialist books may be extremely prestigious.

The observant reader will have noticed that this description of the pecking order contains absolutely no mention of the Internet, of newspapers or of popular magazines. There is a good reason for this: the Internet has absolutely no quality control over the content of the sites accessible through it. If you find an

interesting-looking site relating to your chosen area, it may possibly have been written by a major authority, but it could just as easily have been put together by someone who believes that his/her brain is being controlled by devices installed by aliens. Newspapers and popular magazines have some quality control, but you'll need to treat them as a secondary source and verify anything they report by reading the sources on which they rely.

Online searching

Although review articles and literature reviews in individual articles are a useful way into the literature, they are not infallible and were not written with your particular needs at the forefront of their writers' minds. You therefore need to do your own trawls through the literature to see what's out there and find bits of the literature that are relevant to you. You'll also need to take on the difficult task of deciding whether there's a significant gap in the previous literature – a gap which can act as the reason for the existence of your PhD (i.e. plugging that gap). It doesn't need to be a big gap, for a PhD, but you do need to have taken reasonable precautions to ensure you're not just reinventing an old wheel, and making it square.

Supervisors and externals are not allowed to execute students who include in their literature reviews a sentence starting, 'A search on the Internet found no previous work on this topic' or 'There were no books in the library on this topic'. They are, however, allowed to fail students and to write elegant, cutting comments on the offending page. Why do supervisors and externals get so worked up about these sentences? Because they're equivalent to writing in large letters, 'I am either ignorant or lazy or both'. That is not a signal that you want to send out to the reader.

Bibliographic databases

For a member of the general public, an online search generally involves typing 2.4 words into a search engine (the average length of query) and mis-spelling about 14 per cent of the words they type in. What this typically produces is URLs for websites, most of which have no quality control, as described above. This strategy misses enormous amounts of relevant literature which simply isn't accessible via that route.

As a PhD student, you need to know where the relevant literature for your PhD is actually located. A lot of relevant literature isn't freely accessible to the general public over the Internet because of issues such as copyright; for instance, the copyright of a journal article will usually reside with the journal's publisher, and the publisher will charge a fee for access to it. Some journals have a soft copy of all their material available online, and will let you have access for a fee; many long-running journals are still in the process of putting old issues online, so there may only be printed copies of the article that you're looking for.

There are numerous online facilities available to registered university students via university libraries; it's no coincidence that the title 'library' is often

being replaced by titles like 'information services' to make the point that they don't just provide traditional paper-based facilities. These online facilities include free access to a wide range of online articles, via Emerald, Athens and other systems. It's highly advisable to find out as soon as possible which online facilities your university library offers you. If you need back issues of a particular journal for your literature search, most libraries pride themselves on the number of journals to which they provide access, and on being able to arrange access to more if students need them.

You need to know which online resources are the key ones for your field, and how to access them. You also need to know how to make best use of them once you do access them. A key online resource is the bibliographic database. This may take various forms. It may be a database listing the bibliographic details of numerous articles (typically the names of the authors, the titles of the articles, the journal name, journal volume, journal issue and page numbers for the articles, and a short list of keywords) but containing nothing more – it can help you find the bibliographic reference for a particular article, but you then have to find a physical copy of the article via something such as an inter-library loan request. It may be a database listing bibliographic details of articles, including the abstracts of the articles, so you can get a better idea of whether the article is relevant to you before deciding whether or not to obtain a physical copy. It may be a database which includes not only bibliographic details of the articles, and their abstracts, but also the full text of the articles themselves. There are numerous other forms and variations on these themes – for instance, giving you free access to the abstracts, but charging you for access to the full text. Open access journals offer free access to their contents, but charge the authors of those articles a significant publication fee after their papers have been accepted. Some traditional paper-based journals allow authors to put soft copies of their own articles onto their universities' online repositories or their own websites after a specified interval; others don't.

Advanced search

Once you know which online resources are relevant to you (a chat with your supervisor, and another with a friendly librarian, can be invaluable here) it's a wise idea to learn how to use them properly. The traditional '2.4 keywords with 14 per cent spelled wrong' approach isn't the most useful one at PhD level. It typically produces either far too many hits or far too few. For example, searching for the term *repertory grid* (a technique from psychology) will get huge numbers of hits about repertory theatre and enormous numbers of hits about city grids, power grids, etc. which are completely irrelevant. Something as simple as typing in the two words surrounded by a pair of inverted commas will dramatically improve the percentage of relevant hits on most search engines.

It's highly advisable to find the 'advanced search' option for your online resource and to learn how to use it well. It will probably be one of the best investments of a couple of hours' effort that you ever make. Different systems offer different advanced facilities, but typical examples include an 'only show

me records which have both this word and this other word' option and a 'don't show me records which include this word' option. These options make it much easier to prevent false hits (such as the repertory theatre example) and to broaden your search if you're getting suspiciously low numbers of hits (e.g. if there are several different names for the concept you're searching for and you've been getting low numbers of hits because you've only put in one of those names).

It's also advisable to be systematic about what you do during the search. One good strategy is to write down a list of keywords to try, before you start the search; another is to work through permutations of keywords and options systematically, keeping a record of which you've tried. Another useful tip is to update your list while you do the search. For example, if you were searching for *repertory grid* and *career choice*, then you would soon notice that articles about repertory grids described them as part of Personal Construct Theory, so you might consider using that as a search term (e.g. with the keywords *career choice* and *personal construct theory*). Technical terms and authors' names are usually good keywords (with obvious caveats if the author has a common name such as Smith or Brown), since someone who has published once on a topic is likely to publish on it again.

Searching the literature efficiently can save you a lot of wasted time, and can give you invaluable insights. It's an essential skill, but online searching isn't the only source of information.

Other sources of information

As usual, a cup of coffee with a friendly expert can save you an enormous amount of effort. It is also worth being pleasant to librarians – they have a wealth of information which they are usually happy to share with polite, appreciative people. It is also a good idea to get an overview from a textbook, which will list relevant articles in its bibliography, or from a recent encyclopaedia.

'Sniffing' a paper

Finding papers is easy; a typical online search will find hundreds of potentially relevant and potentially useful papers. In an ideal world, you'd read all of them carefully. In reality, this isn't feasible; the literature in most fields is growing so fast that it's impossible to read all of it. So, you have to prioritise. One effective way of doing this is via an informal 'sniff',[1] the equivalent of sniffing the milk in the fridge to see if it's gone off.

1 This 10-minute technique is based on a seminar by Jorma Sajaniemi.

10-minute sniff test

For each step, highlight the relevant text:

1 Identify the **topic** and **objective** – 3 minutes.
2 Identify the most important **results** and their **implications** – 4 minutes.
3 Identify the overall **research methods** – 1 minute.
4 Identify the **central details** of how the methods were executed, e.g. for an empirical study: number of subjects, materials, etc. – 2 minutes.

This should be enough to allow you to determine what sort of paper it is, how it relates to your research, which aspects are most likely to be of interest to you, and whether you want to read the paper fully. In a sniff test, you skim the paper for basic proxies of quality and relevance: whether it's peer-reviewed, whether the methods look sound, whether the findings look sensible, etc. If it fails all of these, you ignore it, and move on to the next one. If the paper is okay on some or all of the proxies, you also need to think about how it fits into the Big Picture. For example, what does the paper add to the Big Picture? Does it open up new routes, or show that some routes are dead ends? Or is it just another paper finding essentially the same as numerous other papers in this area, and adding nothing substantive?

Don't forget to enter the paper into your annotated bibliography: full citation information, date of review, a summary based on the key information highlighted earlier, the significance of the paper as it relates to your research – what you personally take from it. Record the papers that don't pass the test; it will save you from wasting more time when you happen across them again in the future.

Sniffing is an initial filtering step: there's no substitute for reading well. (And later you can ask yourself if your own papers would pass the sniff test.)

When have I read enough?

The simple answer to 'When have I read enough?' is: never! Reading is part of researching, and you'll always be seeking out new information. However, with respect to a particular review, you're trying to consolidate a representative literature sample. Here are some tips:

- **Start from an informed subset:** ask people; look at reference lists of the papers that inspired you. Later, share your review with informed colleagues and ask if you've missed anything. This is one context in which effective networking is very handy and can provide mutual benefit.
- **Scan before reading deeply:** this will help you identify papers that are focal to your question (and to eliminate papers that are not), and to identify the seminal papers. Read that core set of papers deeply first.

- **Consider your boundaries:** what's relevant to your research question – and what isn't? If you're doing interdisciplinary research, you'll need to achieve depth in your focal discipline, but can offer more selective, albeit accurate, coverage in the other disciplines. For example, in work on wearable devices for rehabilitation after surgery, one might take a strong HCI perspective but only cite a key psychological theory about motivation during rehabilitation. You'll need to articulate clearly what you are not including, and why.
- **Depth vs breadth:** there's a trade-off between depth and breadth of literature reviews; relatively new fields or highly focused research questions require depth in analysing the limited literature, whereas well-established fields typically require a broader overview of the evolution of key strands of thought.
- **Chronology:** you need to cover the full history of key thinking (i.e. go back to original sources), not just rely on the latest literature.
- **Saturation:** recognise the point when you're seeing the same concept or themes, and the same references, repeated. This is called 'saturation' and suggests that you have a reasonable subset of papers. However, there's always the chance that you've covered one pond but missed the ocean next door – so remember to vary your keywords and to continue scanning reference lists and sniffing around relevant publication venues and communities.
- **Write as you go:** reading and writing are mutually supportive of your endeavour to understand the literature. Write as you read, and continue searching and reading as you write. Writing is a way of testing your thinking. It's also a way of sharpening your focus.

What you read versus what you cite

A question similar to 'When have I read enough?' is 'How many references should I have in my dissertation?' It's a sensible, simple question. So is asking: 'How do I repair a broken car?' In both cases, the sensible, simple question has a sensible but complex answer; in both cases, once you understand the complexity, then you're ready to be admitted to the ranks of the experts, whether with a PhD or as a qualified motor mechanic.

The complex answer is: 'You use as many references as you need: no more, no fewer. Once you know how many that is, you're ready for the PhD.' It sounds like a facetious answer, but it isn't. It sparks the obvious follow-up question: 'How do I know how many references I need?' When you stop to think about this question, you'll probably realise that you already know the answer. Every significant point in the chain of reasoning and evidence in your thesis needs to be linked explicitly to the relevant literature. If there are points which aren't linked to the relevant literature, then you haven't got enough references; conversely, if there are references in your thesis which don't link to the significant points, then those references may well be cluttering the text needlessly.

Once you start looking at the 'When have I read enough?' question this way, you soon realise what some of the other follow-up questions are, and what the answers are to those follow-up questions. For instance, there's the question of how you

know what all the significant points are in your thesis, to which the answer is that you can't know that at the start of your PhD: your thesis will develop as you gain new insights from the literature, and those insights will in turn point you towards other reading that you need to do. It's a cyclic process that will go on through your PhD, until your thesis stabilises. The implication is that what you need to read is a different matter from what you end up citing. For every paper that ends up in the reference list in your dissertation, there will be a number of others that do not. What you cite is a selection from what you have read – but determining what literature to cite involves reading a much larger literature.

To reiterate: there is a crucial interaction between reading, thinking and writing: reading informs our thinking; our thinking is what we're trying to express; writing helps us make sense of what we've read, and hence of what we think. The demonstration of mastery is being able to cite what's important to frame your work, and to discuss it critically. There's no short cut to reading relevant literature well. (The first golden principle: *don't lie*, in this case by pretending to have read things that you haven't read.)

Organising the literature

A literature review needs to have a structure; it's a form of map, after all. The structure represents the transition from a collection of papers to an expression of 'the state of knowledge'. The structure is also a way of demonstrating that you have a clear understanding of what you're doing and why you're doing it. It is your responsibility to make your work understandable; it is not the reader's responsibility to make sense of a pile of references indiscriminately grabbed from the Internet and then tacked together with semi-coherent prose.

Effective structures are based on an explicit *organising principle*, such as chronology (beginning with the earliest work in this area and proceeding via the most important past work up to the present), thematic threads, key issues and how they are addressed, or schools of thinking. Some topics draw on a number of literatures, and the review may be organised either in terms of those contributing literatures or in terms of themes that cut across those literatures.

The best organising principle is the one that serves your research question. One simple way is to use top-down decomposition. This involves starting with a very short list of key points – roughly half a dozen insights that characterise 'the state of knowledge'. For example:

Elicitation of software metrics via card sorts

- Choice of metrics for software is difficult
- Card sorts should have advantages over previous methods for choosing metrics
- What happens if you use card sorts in this area?
- Card sorts do have advantages over previous methods in some ways.

Once you are happy with this top-level structure, you then break down each part of it into smaller parts and repeat the process as necessary (for instance, unpacking the ways in which card sorts have advantages and the ways in which they don't). You should end up with a set of points, sub-points, and so on which will give you the main structure.

Mind-mapping and conceptual mapping are other useful structuring tools, whether on a whiteboard or using software. Sorting good old-fashioned index cards (or Post-its) on the wall, table, or floor in different configurations is also helpful. There is usually more than one possible structure; the right one is the one that serves your question and thinking.

Using material from the literature

You will never lose by giving credit. Indeed, you are likely to gain respect and trust by doing so fastidiously. Doing so shows not just that you behave with integrity, but also that your reading is broad and that you are clever enough to gather and synthesise information from a variety of sources.

Citation styles vary – for example, APA (American Psychological Association), MLA (Modern Language Association), Chicago/Turabian, Harvard – and different publication venues and universities specify different standards. What they all have in common is the expectation that the citation will provide full bibliographic information, including: author(s), year of publication, title, venue, volume and issue (if relevant), page numbers.

Plagiarism

The interpretation of what constitutes plagiarism is subject to cultural variation. To avoid errors of interpretation, it's worth adopting the strictest, which happens to be the interpretation used by academic journals and publishers in the UK, USA and western Europe. Plagiarism is using someone else's ideas, words or material – directly or indirectly – without giving them credit. The rules are very clear.

- Any time you use ideas, words or material of any sort that relates to a specific source, you *must* attribute it to that source. Paraphrasing (restating) still requires explicit attribution
- Any time you use someone else's words *verbatim,* you must put them in quotation marks and attribute them to that person
- Use of figures or images typically requires explicit permission from the author.

Let's be absolutely clear. Plagiarism is academic suicide. In British academia, plagiarism is a 'mortal sin'. If your dissertation plagiarises, *you will fail.* If you submit work for publication that plagiarises, your work will be rejected and *you will be blacklisted.* So, if in doubt, attribute.

Incomplete or non-existent references: why they are sinful

Many – perhaps most – researchers have had the experience of stumbling quite by chance across a description of a piece of work in an unrelated discipline which has enormous implications for their own work. If that happens, it is enormously frustrating to have to spend months or years trying to track down the relevant article because the person who mentioned it does not give an adequate reference.

Conversely, if you're a PhD examiner and you see that a substantial part of the candidate's thesis is based on a dodgy-looking claim without proper supporting references, one of the first things you will do is to question them in detail about the references behind that claim. An answer of 'I saw it in a book somewhere; trust me' is unlikely to lead to a happy ending.

References are functional, not decorative; good referencing is a sign of a good researcher.

Keeping an annotated bibliography

Part of doctoral study is acquiring one's own core repertoire. The annotated bibliography is an effective mechanism for facilitating this acquisition – and for keeping a record of the majority of papers that fall outside the core. The annotated bibliography is a powerful research tool. It should be a personal tool, keying into the way you think about and classify things.

What the annotated bibliography should include

It *should* include, as a minimum:

- The usual bibliographic information (i.e. everything you might need to cite the work and find it again)
- The date when you read the work
- Notes on what *you* found interesting, seminal, infuriating, etc. about it. The notes should not just be a copy of the abstract; they should reflect your own critical thinking about your reading. They can be informal, ungrammatical, even inflammatory, as long as they retain meaning about your reading. If you read a paper more than once and get different things from it, then add to the notes – but do keep the original notes, which can prove useful even if you've changed perspective or opinion.

It *can* include many other useful things, such as:

- Location of the physical copy of the work (e.g. photocopied paper, book borrowed from the library, book in one's own collection)
- Keywords, possibly different categories of keyword
- Methods used, characterising details of study implementation (e.g. participants, data)

- What theory underpins the research
- Further references to follow up
- How you found the work (e.g. who recommended it, who cited it)
- Pointers to other work to which it relates
- The author's abstract.

The discipline

Keeping an annotated bibliography is a discipline. It is easiest to establish a discipline of writing notes about papers as soon as you read them and not moving on to the next paper until you have done so. It's *much harder* to go back and try to catch up. Because keeping the bibliography is an 'overhead', and because the point is to maintain access to material, it's best to keep entries to under a page per paper.

Never delete things from the bibliography. 'Discards' can be re-categorised or filed away separately, but one year's 'junk' may be another year's 'gem' (and vice versa). There is also genuine value in keeping track of the changes in categorisation: one way is to keep a list of working category 'definitions'. Don't discard the old scheme after a revamp; rather, file it as part of the record.

The discipline is to keep up a continual, accumulating record of your reading and thinking.

Other ways the bibliography can help

- It can help you to 'backtrack' on your own thinking
- It will reflect the evolution of your reading, of what you found important over time, and of your writing about what you read
- When you find a reference and can't remember the paper's particular perspective, the notes can give you the key
- When you re-read a paper just before your viva and say, 'Oh no, it doesn't say that at all, what could I have been thinking?', then the notes will be invaluable.

The bibliography can help you to manage your reading effectively and keep accessible much more information than you can remember without aid. Always remember:

- Keeping a bibliography allows you to use a 'flat', unambiguous physical filing system (e.g. alphabetical by author) while being able to categorise, re-categorise and search fluidly
- The bibliography can help you avoid re-reading papers that are useless and forgettable but have interesting titles
- The bibliography can help you keep track of the physical form and location of materials.

Mechanisms

There are different ways to keep a bibliography, including electronic databases and card catalogues. Contrary to what many students believe, card catalogues are not an outdated relic of the past; there are a lot of things you can do with card catalogues which you can't do with an electronic database (for instance, spreading the cards into clusters on a flat surface to look for trends and patterns in the literature). You need to find the method that works for you; asking advice from experienced researchers can provide invaluable ideas. Examples of bibliographic software packages include:

EndNote: www.niles.com
Citavi: www.citavi.com
Mendeley: www.mendeley.com
Zotera: www.zotera.org

Many people don't use specialist packages, preferring to adapt database, spreadsheet or word-processor usage. Many effective bibliographies are simply kept as very long text files.

Enjoy reading

A closing thought is that reading should be a source of pleasure to you, at least some of the time; if it isn't, it's worth asking yourself whether it's time to look for something outside academia as a career. Many students, though, feel guilty about reading for pleasure. It's worth remembering that there's usually no way of knowing in advance what will turn out to be useful reading, and what won't; unexpected discoveries in apparently unrelated literatures are a common feature in top-level research. So, read, read well, and read happily.

Table 6.4 Reading habits of lifelong readers

- Steady consumption. The idea is not so much to read voraciously as to read regularly. Use a tortoise strategy, rather than a hare
- Always carry reading with you – use the ten minutes on the train platform, or while you're waiting for your supervisor, or between seminars, or while dinner is cooking
- Leave papers lying around where you're likely to pick them up and read them – in the bathroom, for some people, or the bedroom for others, or by an easy chair, or in your bag to read on the train
- Keep an annotated bibliography – and keep it up to date
- Find a regular reading time, about an hour a day. For many, this is first thing in the morning. Don't go straight to your office; go to the library first for your hour
- Read books as well as papers; learn about the different types of books.
- Most great readers are a little obsessive and like to get a sense of 'completeness' when they're reading on a new subject. Many 'map' the key writers
- Make sure all your photocopies of papers and your records of references have full citations on them, down to the ISSN or ISBN and page numbers – some publication venues require all of this, and having to track the full details down because you didn't record them the first time can be a real pain
- Most great readers maintain more than one reading strand – so morning time may be technical reading, while bedtime is philosophy reading
- Read a chapter every night before you sleep, no matter how tired you are
- At conferences, carry the proceedings to the sessions with you and annotate the paper with your notes during the talk
- Even when you find a paper uninteresting, cast your eye over the remainder, so that you have a portrait of the contents
- Use your network to filter your reading, hence increasing the interest level of what you pick up
- Join (or form) a reading group, or find a reading buddy
- From Feynman: When reading something difficult, if you get stuck reading something, start again from the last point that you remember
- Elapsed time can help: skim-read the material, then set it aside briefly before coming back to read it thoroughly.

Chapter 7

Paper types

• Data-driven papers • Methods papers • Theoretical papers • Consciousness-raising papers • Agenda-setting papers • Review papers • Position papers • Paper types: conclusion

Why have we bothered to include an entire chapter on paper types? One reason is that becoming an expert in any field involves learning all about the tools of your trade – for instance, learning the difference between a tenon saw and a fret saw. Why? Because you can do things with the right specialist tool that would be difficult or impossible otherwise. This chapter is about what you can do if you know about different types of paper; for instance, when you can get a paper published in a good journal with a tiny data set, and when you can't, or what type of research you would need to do to get a paper published in a particular journal as part of your career plan.

Academic writing is not just an intellectual activity, but also a social one. It's about making your research available for scrutiny, critique – and use. Making a 'contribution to knowledge' entails communicating advances to the community of researchers, the ones you hope will read your papers. All academic writing requires certain ingredients:

- Context/situation
- Justification of the content
- Substantiation of claims (evidence of rigour)
- A 'coherent and explicit chain of reasoning': appropriate structure, clear argument, a coherent overall vision
- Discussion of implications.

Each type of writing has, in addition, a particular purpose and a particular social context – an intended audience. The purpose and content of a paper will

determine what type of paper it is. The publication forum and intended audience will influence how long it is, what voice it should have and what elements should be prioritised.

There are different ways of categorising papers. These are seldom described in writing; they are usually treated as craft skills, and also as a matter of personal choice. The categorisation described here is a fairly standard one, and some of the paper types in it are recognised fairly formally (for instance, journals have an explicit category of 'review article'). Others, such as 'method-mongering paper', are less formal.

Data-driven papers

This is what most people tend to think of when thinking about papers. The data-driven paper reports on some form of empirical study, describing the study but concentrating on presenting and discussing the data (as opposed to the methods used to gather the data, for instance). The purpose of data-driven papers is to publicise the study and its findings (and ideally to provide sufficient information for replication and critique). Classic examples include survey reports, experiment reports, reports of benchmarking exercises that compare the performance of different systems on given tasks, reports of other sorts of empirical studies, such as observations and interviews, evaluations and case studies. The key ingredients of data-driven papers are: what question is addressed and why (and its theoretical context); a description of the study design, implementation and conduct (including justification, protocol, etc. – notionally in enough detail to allow another researcher to repeat the study); the results (data collected, analysis, findings); and a discussion (significance, limitations, claims to generalisation, implications, further work).

Data-driven papers are important for several reasons, and astute researchers using the 'cabinet-making apprentice' model of research will take care to have at least one data-driven study in their portfolio, if only to demonstrate that they know how to do them.

If the central focus of a paper is the data, then the data need to be good. This means (a) solid and also (b) interesting. *Solid* means that the sample size, quality, representativeness, etc. need to be at a level where nobody sensible will even think of questioning them. Novice (and, often, less novice) researchers tend to spend a lot of time worrying about their sample size, on the grounds that more must be better. They also spend quite a lot of time worrying about representativeness, because representativeness is something they feel comfortable speculating about – anyone with an armchair and reasonable general knowledge can usually find several reasons for querying the representativeness of a sample without much effort. These scruples tend to be slaughtered on the altar of expediency the moment that the questionnaires go into the post (questionnaires are a favourite method for collecting large and dubious data sets). If you're doing this sort of work, you need to know about statistics. Unfortunately, novice researchers tend to spend less time considering the quality of their data (lest they talk themselves out of publishing at all).

The need for *interesting* data somehow tends to receive less attention among novices, though experts are well aware of it. This is probably because novices do not usually give much thought to what will be in their data until the questionnaires arrive in the post, and then fade out of public view when the full banality of their results becomes apparent. A more experienced researcher will probably take the view that the best way of conducting a fishing expedition is shooting the fish in a barrel (i.e. only doing a large data-gathering exercise when there is an extremely good chance that the data will produce an eye-catching result).

What catches attention is normally a surprising and useful finding, based on a sample so solid that the data can be treated as a safe foundation for further work. An example of this from computer science is the '5000-year fault', i.e. the bug which might only be expected to materialise once every 5000 user-years of use. The classic paper on this topic used a very large data set to show what proportion of bugs could be expected to surface with what frequency, and showed that a surprisingly high proportion might only appear once every few thousand years. This has profound implications for the software industry, in areas such as debugging and the development of ultra-safe systems for safety-critical areas such as software for controlling nuclear power plants. An added attraction for the researcher who publishes such work is that it will be quoted in just about every subsequent paper on the topic, thereby boosting the researcher's reputation considerably.

How do you know when you're dealing with fish in a barrel (and therefore a suitable area for a big study) as opposed to an empty pond? This is where a good understanding of theory is useful, because it can lead you to predict a counter-intuitive finding. Another useful approach which complements theory is keeping an eye open for interesting effects while carrying out other research.

A classic data-driven paper can make a reputation. Most data-driven papers, however, do not break new ground; you need to have solid, interesting data to make a reputation from this type of publication. Or you need a series of solid, interesting data-driven papers that accumulate into a coherent body of work.

There are a number of variations on data-driven papers.

- **Meta-study papers:** data-driven papers also include meta-studies, which compile and analyse the data from a number of sources such as previously individually published empirical studies. Key ingredients are: a clearly stated purpose; a selection of appropriate and well-understood source material (accurately cited); a clearly stated basis of analysis; and a good discussion
- **Artefact papers:** the purpose of the artefact paper is to publicise the new artefact (tool, system, pedagogy, instrument, whatever) and to provide sufficient information for critique and application. Its key ingredients are: what it is (a thorough description); what gap the artefact fills (precursors, theoretical context if any, purpose); why it's novel; what key design ideas or innovations it embodies; evaluation (evidence of its effectiveness for its purpose); and where it leads

- **Work-in-progress papers:** the work-in-progress paper is about 'making a stake' or 'marking a territory' by publishing a key idea or approach and having it associated with your name. It's a form of premature commitment, with publication preceding much of the research and most of the evidence, but it can involve you in early discussions in a new field. The key ingredients are: a strong idea; clarity about where the idea fits in the 'territory' and how it's distinguished; and speculation about its implications (if it works). It helps if there's also a description of the research programme and a demonstration of concept.

Methods papers

Methods papers describe a new method, technique, algorithm or process (or a new variant of any of these) to a given community for a specified usage. Good methods papers describe the method and explain how to use it in sufficient detail for a reader to apply. So the key ingredients are: what it is; how it works; what it's good for – both its utility and what distinguishes it from other related methods; and a discussion of any constraints on its use (e.g. level of resolution, conventions of use, limitations, costs). There are different subtypes of methods papers.

- **Method introductions:** these describe a new method, invented or developed by the author(s). Because the method is new, the justification is particularly important: the authors have to make the case for why the method is needed, what it's good for, how it's distinguished from other existing methods and how the authors know it works. Sometimes the authors are so busy justifying the method that they neglect to describe it fully, and readers are tantalised by the potential without the wherewithal to realise it themselves
- **Tutorial papers:** these describe a method and explain how to use it. The method may not be original – it may be the full elaboration of a method introduced elsewhere, even by other authors. Good tutorial papers typically include worked examples. Such papers are invaluable, but journals are not fond of publishing them on the grounds that they do not normally involve original research, which is what journals are all about. However, if you do manage to publish the classic tutorial paper for a method, then people will quote it for years to come
- **Method-mongering papers:** these describe a method with the aim of suggesting that it should be more widely used. The method may be original (i.e. developed by the authors) or may be an established method from another field which has not received sufficient attention in the field for which it is now being described (known as re-contextualisation). It is possible for a paper to be a method-mongering paper without being a tutorial paper. A common example of this is a paper which shows how a method can be applied to problems in the researcher's field, but which does not describe the method itself in great detail – instead, the author typically refers the reader to a suitable tutorial paper or textbook. One advantage of method-mongering papers

is that if you are already familiar with a suitable method from another field, then you can put together a method-mongering paper fairly easily; all you will need are some nice examples of your method-cracking problems, traditionally viewed as difficult in the new field of application. You don't normally need a large sample size, since the point is made just as effectively with a small sample (or even a single example, if it's a good one)

- **Demonstration-of-concept papers:** these involve demonstrating that a particular concept (usually a method, but not always – it may, for instance, be a conceptual framework) is feasible, useful and interesting. This is a handy precursor to applying for funding. If you know what you're doing, you can get away with a single set of data from a single subject for a demonstration-of-concept paper. The tricky bit is finding a suitable concept in the first place . . .

Theoretical papers

Theoretical papers discuss theory from a variety of perspectives:

- Introducing new theory
- Explaining someone else's theory so that it makes sense
- Refining or extending existing theory
- Critiquing or debunking existing theory
- Setting the agenda for needed new theory (without actually proposing that new theory).

Or they may stop short of theory *per se* and offer theoretical constructs such as models, concepts or conceptual frameworks. The key ingredients are the theoretical insight and the argument that presents and justifies it.

Theoretical papers can also discuss theoretical issues such as the inherent limitations of symbolic reasoning, and can be highly influential. The published papers of this type are typically written by authorities in the area, and actually have quite a large component of review and methodology in them (it's difficult to tackle advanced theory properly without considerable reference to the literature and to the methods used in the area). The unpublished papers of this type are typically written by inexperienced new researchers who have not bothered to do the research equivalent of reading the FAQs first. It's advisable not to try writing theoretical papers until you're sure you're ready for the task and have evidence to support this belief.

Consciousness-raising papers

These are less psychedelic than they sound. They are intended to raise awareness of issues which have not previously received sufficient attention in a field

of research; these issues often involve application of methods or concepts which are standard in another field, but not well known in the field where the consciousness-raising paper is written.

Good consciousness-raising papers can attract considerable attention, and can change the viewpoint of an entire field. Bad ones can give the author a reputation as a pompous windbag. As usual in research, one of the touchstones is whether you're giving the reader some really interesting new tools to play with. Saying that (for instance) the methods of the physical sciences are not always directly applicable to the social sciences may well be true, but it doesn't really get us anywhere. Saying that (for instance) game theory can be used to provide a mathematical grounding for evolutionary ecology is the research equivalent of giving a small child the keys to a toy warehouse, and made John Maynard Smith the revered founding father of an entire new field of research.

A related type of paper is perspective papers, which are, at best, interesting or provocative essays about a topical topic. They present and justify a view of the topic, contrasting it to other perspectives. The key ingredients for both consciousness-raising and perspective papers are the same: a strong idea; a strong, rich argument, showing not just what the perspective is but also how it affects research and understanding; weight of experience, sufficient to provide a rich context for and instantiation of the perspective; and speculation about implications.

First-year students are fond of complaining that their field neglects various important issues. They are usually less fond of checking whether this is a standard complaint of first-year students and whether there is a good reason for these issues being neglected. Experienced researchers (a) have heard a lot of first-year students talking and (b) have reliable chums who can be used to see whether a promising idea will pass the giggle test, before going any further with it.

Agenda-setting papers

Related to consciousness-raising papers are agenda-setting papers, which are about pointing out new directions, mapping out journeys and generally playing navigator for a research community. There are two broad types of agenda-setting paper: stolid ones written by committees (the only sort in which it's acceptable to state the obvious) and visionary ones written by individuals. If the agenda is one to which enough of the community subscribes (or alternatively is the sort of 'straw man' a community can revel in disparaging), the agenda-setting paper is likely to be cited heavily.

Good visionary agenda-setting papers require (a) vision and (b) genuine authority, based in a comprehensive, up-to-the-minute knowledge of the field, a critical creative turn of mind and powerful insight into how fields develop. It really helps if the author also has a substantial reputation, lest the readers wonder 'Who is so-and-so, to set the agenda for us?' But it's not necessary, and an influential agenda-setting paper can gild an established reputation or create one for a bold and inspired researcher.

Review papers

Thucydides would have approved of review papers. Every ten years or so, someone in a given field will decide that the time is right for a paper surveying the key research in that field since the last review paper was written. They will then survey all the main papers, and many of the minor papers, written over that period. This is a very substantial undertaking and can easily involve reading and assessing hundreds of papers and books, in addition to identifying and summarising the main themes within that work.

Review papers are invaluable for ordinary mortals, since they provide an excellent way into a body of research, complete with overviews and key readings. But good review papers are more than just annotated bibliographies. They 'add value' to the reviewed literature by organising it, either revealing the underlying structure or bringing structure to it, and by considering it critically and systematically. A few review papers take a particular, stated perspective. The key ingredients for a review paper are: specification of the focal topic; identification and description of the main strands of thinking (perspectives, approaches) and theory; honest, competent paraphrasing of seminal papers; genealogies of ideas (where they started, how they propagated and were developed); and, of course, comprehensive references.

Review papers are typically written by people so utterly familiar with a field that they will have read all the relevant papers anyway (and will probably have written quite a few of them as well). However, there is one useful exception to this generalisation: if you have done the literature review for your PhD properly, then it should (pretty much by definition) provide the basis for a good review paper. However, there is a crucial difference between a review paper and the literature review in a dissertation: the former is a general, balanced overview of a field; the latter is a focused review whose purpose is to set the context for a particular programme of research. Therefore, although the reporting should be accurate in either case, the editorial and prioritisation choices for the two reviews may be quite different. In practice, most people by this stage of their PhD are so sick of the topic and/or scared of being told that they've missed something vital that they find reasons not to go down the review paper road.

Position papers

Position papers are not so much about presenting research as presenting researchers. They usually arise in connection with a workshop or event, for which the organisers wish to assemble an interesting group of participants, and so they are always targeted to the event. The trick to position papers is distinctiveness; they are about portraying yourself as being interesting and having something to contribute. The key ingredients are: credentials (why I'm worth listening to); expression of interest (why I want to participate in the event); and position (what I can offer, and why I'm interesting). The trick is to express

personality without excluding yourself. Position papers may include information about research, but usually in summary form, in the service of establishing the distinctive contribution the author makes to the community.

Paper types: conclusion

Looking at these categories, you should be able to map your existing and intended research onto different paper types. If your research involves importing an established method from one field into a field where that method isn't established, then you're in a good position to write a method-mongering paper about it (or several other types of paper) and will only need a small data set to illustrate your point. If you've just finished the literature review for your PhD, you may be in a position to write a review article, which will look very different from a method-mongering paper, and which probably won't use any data at all, other than the articles being reviewed. If you're trying to test the evidence relating to an evidence-based issue, you'll need to aim for a data-driven paper, with as large a data set as it takes. You may well be able to get two or more different papers out of the same piece of research, with each one focusing on a different aspect of the research.

So, different types of paper are useful for different purposes; you may find it a useful exercise, whenever you plan a piece of research, to ask yourself what type(s) of paper you intend to get out of it.

Chapter 8

Research design

• Designing empirical studies: three key steps • Methodology • Types of research and research focus: machetes and magnifying glasses • Ethics • Tales of horror and how to avoid them • The three ignoble truths (with apologies to the three noble truths)

Research design is a topic that requires a book in its own right. Excellent books exist on this subject, and we suggest that you read several. This chapter doesn't pretend to cover research design in detail. Instead, it offers an overview of the nature of the research endeavour and concentrates on the thinking and planning that precedes the choice of research methods.

Research involves finding something new. 'New' may mean 'new to everyone', or it may simply mean 'new to you'. 'New to you (but not to everyone)' typically involves reading the literature to find out what has already been done, or re-discovering solutions to problems that have already been solved. The former is important when you're doing the preparatory work before some primary research, since it vastly reduces the risk that you will waste time on the latter.

Discovering something 'new to everyone' by gathering new evidence is known as *primary research*, and is typically what you need in order to earn a PhD. However, finding something 'new to everyone' can also be achieved by treating the literature or existing data as something to research, known as secondary research. One example is meta-studies that reassess the data from a number of studies, often from a number of sources, in order to address research questions across the collection. Sometimes, such meta-studies can make breakthroughs, perhaps by identifying an overlooked factor or an unnoticed assumption. For example, in 2001 Ben Oppenheimer and colleagues identified white dwarf stars, the first direct evidence for dark matter, from a collection of data that had been lying around for between 6 and 30 years.

Designing empirical studies: three key steps[1]

This section describes a simple but effective way of designing research in three steps: question – evidence – technique.

1. What's the question?

The best way to find a brilliant answer is to ask the right question. In order to ask the right research question, you need to identify what is important to know, out of what might be known. This typically involves remembering whatever motivated you to ask the question in the first place, and assessing whether it is something that you can reasonably – and feasibly – study within your available resources. Resolving the question into something you can address often involves breaking it down into smaller, more tractable questions, and choosing one of those. This is a core skill, and learning it is a key part of a PhD. Bad research questions are a common cause of (at best) wasted time and (at worst) failed research, or (occasionally) of tragedy when a mistaken result is used for public policy-making. A good research question *reduces the problem space* in an area. This means that the answer, whatever it is, eliminates one set of plausible possibilities. You can then ask another question that will further reduce the problem space, and so on, until there is only one sensible explanation for the problem which corresponds with the facts. A classic example is Pasteur successively eliminating possible answers for the cause of decay in foodstuffs.

One way to approach research design is to imagine that you have an answer of a particular type, and then to ask yourself whether it actually tells you anything useful; does it pass the 'So what?' test? Imagine that you've been wrestling with the 'nature–nurture' debate concerning how much of human behaviour is determined by genetics and how much by environment; imagine further that through brilliant research you have found the answer, and that the proportions are 42 per cent and 58 per cent respectively. Once you've finished celebrating, what can you do with that information? Come to that, what exactly does that information mean? Phrased this way, it's not exactly a very helpful answer, and you start realising that it would be better to have started from a more useful phrasing of the question. Asking the 'So what?' helps you to consider the question in terms of what an answer might contribute to the discourse, not just in its own terms.

A useful tactic is to draw the question as a box, and draw a line out of it for each of the logically possible answers. Beside each answer, you should be able to write:

- 'This answer is interesting because . . .'
- What you will do as a result of this answer

1 This section draws on material introduced and rehearsed in a variety of teaching contexts and presented in a different form in Fincher, S. and Petre, M. (eds) (2004) *Computer Science Education Research*. London: RoutledgeFalmer. Used with permission.

- Why this answer would usefully reduce the problem space
- What the practical implications would be (very useful if you're looking for funding).

If you can't do this for one or more of the answers, then you're gambling time, effort, and reputation. Even if you're lucky, it will be clear from your research design that you've asked a flawed question and made a lucky guess. Examiners view such sins in much the same way as driving inspectors view learners who overtake on blind bends on the hunch that there's nothing coming: you may be lucky on one particular occasion, but nobody is going to give you a driving licence.

Thinking about the destination should help you to establish the following:

- The importance of the question (why is it worth answering?)
- The likely significance of the findings (what you'd know as a result, what the findings would let you do next, what practical implications they have)
- The implications for theory (how the findings relate to available explanations and predictions)
- The limitations to generalisation (whether or not your conclusions are likely to apply to other data).

These considerations distinguish questions worth asking.

2. What evidence will answer the question?

The second step is deciding what sort of evidence will reduce the problem space, as well as satisfying the other stakeholders in your PhD – who might all have very different criteria for evidence. For example, the examiners will want to see that you are satisfying the cabinet-making criterion of showing mastery of core skills and knowledge from your discipline. What would a sufficient answer look like? What evidence would be 'good enough' to underpin that sufficient answer? Answering this requires that you consider how the phenomenon of interest is manifest: how it is observable (directly or indirectly) in the world. This allows you to phrase your question in terms of things you can observe – in other words, to 'operationalise' your question.

One way to approach this is to consider what kind of evidence made you think the question was worth asking in the first place: both why that evidence was enough to make you ask, and what was missing from that evidence in providing an answer. Another approach is to consider what sort of answer would not be sufficient – what would a 'non-answer' look like? Thinking about what an answer isn't helps clarify what it should be. Thinking about what sorts of answers would be inadequate can also help in distinguishing between your question and related questions. A third approach is to consider the counter-evidence. People tend to seek confirmatory evidence, to prioritise evidence consistent with what they believe to be true. But often insight lies in the surprises, the unexpected, the contradictions.

Doing good research relies on knowing the value of evidence. Theories are supported or contradicted on the basis of evidence. It's a matter of whether the

evidence is sufficiently sound and convincing for its purpose, a matter of understanding enough about evidence to assess how much you're willing to rely on it. Evidence is not proof. In general, it is whatever empirical data is sufficient to cause us to conclude that one account is probably more true than not, or is probably more true than another.

'Fitness for purpose' and 'sufficiency' are clear different from a 'one-size-fits-all' notion of evidence. They suggest that different standards of evidence apply for different purposes. Some purposes need strong evidence. For example, deciding whether light therapy reverses Alzheimer's symptoms would demand compelling evidence of efficacy. Some purposes need only weak evidence. For example, a 'demonstration of concept' might only need weak evidence that something is feasible, leaving clarification about how well the goal is accomplished to further research. Some purposes need only counter-examples. For example, when one is trying to dispute an assumption or a universal claim, one only needs a single counter-example. The historic example is the first black swan discovered in the eighteenth century, which contradicted the until-then-universal claim that 'All swans are white'.

We need to assess the nature and quality of evidence: how reliable the evidence is likely to be (would repetition by different researchers, at different times, with a different sample of the same population, produce consistent results?) and how robust (would repetition across different related tasks, or across different environments or contexts, produce comparable results?). We need to understand not just the value of different forms of evidence, but also how different forms compare and how they might fit together. In the same way that we report the standard deviation associated with a mean, we must report the uncertainty and error associated with evidence – hence enabling assessment of its fitness for purpose.

3. Choose a technique that will produce the required evidence

Choosing the means comes last, after sorting out what you want to know and how you might know it. Choosing the methods or techniques follows from the question and from what evidence you need to address the question. This is true whether your research is theory-driven or inductive. The techniques for eliciting beliefs from decision-makers are quite different from the techniques for measuring the physical properties of materials – choosing appropriate techniques requires a clear understanding of what kind of phenomenon is being captured and what the available techniques can and cannot deliver. One handy tip is to look for stories about previous projects which answered the sort of question that you want to answer. They're likely to give you some useful ideas about how to go about answering your question.

OK, so it's not that simple

Of course, the 1-2-3 scheme is a simplification, like any model, which is both a strength (it helps you make sense of the key points) and a weakness, because some useful information doesn't fit neatly into the model. The three steps are

not strictly discrete: working out what the question is usually requires thinking about evidence, which entails thinking about what can be observed, what data can be collected, and how it might be analysed. In practice, the design of empirical studies is a highly iterative process that cycles through question, evidence, techniques (including analysis). Iteration is a key part of successful research design; being mentally ready for it is a good start. Also, this model doesn't address ways of handling sudden unexpected opportunities, when you get a chance to study something that is usually out of reach, and when you have to make a rapid decision about how best to proceed (or whether it would be better not to take the opportunity). That's a complex skill in its own right, and leads into territory where the familiar cup of coffee is the best place to start. Overall, though, the model is a good starting point.

The step with no number: conduct a pilot study

Pilot studies are the first defence against oversight (or stupidity) and the bias it may invite. A good pilot study is practical; it lets you work out the bugs. It provides a chance to test the feasibility of the protocol, to practise the procedures and actually use the equipment, to check the timing, to expose disparities in interpretation (particularly those between the researcher and the participants), and importantly to try out the analysis on genuine data. It can expose design flaws, hidden assumptions, and unexpected problems – and generally spare you pain and embarrassment downstream.

If a pilot study is really going to do all that, then it has to try out every aspect of the main study. It must be a genuine 'dress rehearsal'. It must use the full protocol, the actual instruments and materials, and participants who are representative of the target population (not students standing in for experts, or car mechanics standing in for rocket scientists). The protocol (the specification of procedures, instruments and materials of data collection and analysis) must be tried out, debugged, and tried out again until it is clear that the protocol will work as intended and that it will generate data which will be pertinent and can be analysed usefully.

It is also crucial to pilot the analysis; what goes wrong with an analysis can reveal fundamental shortcomings in the study design. For example, the data collection may fail to meet the prerequisites of the proposed statistical tests. It's better to spot problems early than to collect inadequate or irrelevant data.

It's true that pilot studies are expensive of time and resources, but the consequences of omitting them are likely to be even more expensive. Many students don't see the point – until it's too late and their study has gone hideously wrong. In that sense, conducting pilot studies is like investing in a smoke detector: an expense, but one that can avert catastrophe.

Methodology

Many disciplines (especially long established ones with an accepted theory base) have widely accepted methodologies. Many students in those domains

are awkwardly aware that they're not sure of the difference between a methodology and a method. A methodology is a joined-together set of methods and techniques. The joining together varies in formality. Some methodologies are informal; others are highly systematised, with clear explanations for how and why everything within them fits together in a particular way.

Methodologies have advantages; for example, they (ideally) provide a tried and tested framework, and they allow researchers to compare and contrast results across different studies, because the methodology is constant. They also have disadvantages; for example, the methodology can channel research into a limited number of questions and methods. Just because a methodology lets you answer one type of question well, does not mean that you should be focused on that type of question in the first place.

Types of research and research focus: machetes and magnifying glasses[2]

Research is about exploration in the pursuit of knowledge. In The Past, the first stage of exploration would often involve explorers with machetes hacking through undergrowth, with notebook and pencil in pocket. The result of this would typically be a set of sketch maps drawn from whatever vantage points were available. Some of the information would be quantitative, involving measurement – 'about five leagues wide'. Some would be qualitative, involving the types of thing present: 'dense jungle' or 'here be dragons'. The maps would be imperfect and incomplete, but they'd give you some idea of what was over the horizon, and of whether you'd found a modest island or a mighty continent. Subsequent explorers would fill in the gaps with some basic surveying tools and produce moderately accurate maps; if someone decided to build a town or stake mining claims, then they would bring in theodolites and measuring chains, producing extremely precise maps.

It's similar in research. Someone discovers a new area of research, and hacks around in its undergrowth for a while, armed with the equivalent of a machete and a notebook. This might translate into participant observation or unstructured interviews in some disciplines, or digging a trial trench in others. The purpose of this machete stage is understanding the basic layout and geography. The questions at this stage tend to concern what's there.

If the area looks interesting enough, then a fresh batch of researchers arrive, with tools that will give more accurate results, perhaps via field experiments. The purpose of this stage is to map the land more precisely. The questions at this stage are concerned with what exactly is observable, but also how the land is configured, and how it created the features that we see in it.

If it's really interesting, then the equivalent of theodolites will appear, in the form of controlled experiments. The purpose of the theodolite stage is to address very precise questions that arise from the model, and to use precise

2 This section is quoted from Rugg, G. and Petre, M. (2007) *A Gentle Guide to Research Methods*. Maidenhead: Open University Press, pp. 33–6. Used with permission.

observation to eliminate any sloppiness or misconception arising from earlier, less precise assays. The questions at this stage are concerned with working out which bits of the map are wrong.

This recalls a quotation from Sir Eric Ashby, to the effect that, although we like to think about research in terms of great cartographic expeditions hacking our way through the jungle with machetes, more often 'research is crawling along the frontiers of knowledge with a hand lens'. The vast majority of research activity concerns questions of minute precision, the sort of detail that hones theory and drives controlled experimentation. Measured precision is what characterises the Ordnance Survey map and distinguishes it from the swiftly hand-rendered sketch in the field notebook. Each map has its time, its purpose, and its place in the process.

Why, you might wonder, don't people start with controlled experiments and cut out the preliminaries? For the same reason that you don't begin exploration with theodolites and measuring chains: these are comparatively slow, and you need to decide whether it's worth investing time and effort in getting so much detail about a small part of the terrain when you don't even know what's over the next hill. The machete and notebook may be imprecise, but they give you a pretty good overall idea of the big picture fairly fast, which then allows you to decide which places merit more detailed investigation.

Within primary research, there are various types of research, such as case studies, field experiments, and formal experiments. Most students get lost in the big picture of this, which is why we're covering it here. The next sections look at types of research ranging from the equivalent of machete-and-notebook exploration to millimetrically accurate surveys with theodolites and measuring chains.

Describing things: what are the entities?

When you're Out There with your machete in your hand and your notebook in your bag, trying to make sense of the surroundings, one of the first things you need to decide is what categories to lump things into in your sketch maps. Some are easy – rivers and mountains are pretty much the same wherever you are, for instance. Others are more difficult. 'Forest' might at first sight appear an easy one, but it isn't: European forests are very different from tropical rain forests and from cloud forests, for example, and within tropical rain forests there's a big difference between high canopy forest and secondary growth, in terms of how easy it is for you to move around. As a result, you'll need to work out which categories to use in your sketches and notes. This will probably be completely qualitative – you're saying what kind of things you're seeing, but you're not trying to quantify and measure them.

It's much the same in research – you can do useful work just by describing something that hasn't been described before. The splendid Anna, a PhD student of our acquaintance, for instance, investigated which criteria people actually used to prioritise tasks, as opposed to the criteria advocated in textbooks, and found some fascinating things. That didn't require numbers, just categorisation and description.

Readers with archaic tastes will probably already have guessed that this maps quite neatly onto mediaeval scholastic questions such as *'quae sunt entitiae?'* but we'll refrain from venturing down that particular route . . .

Counting things: the utility of rough measures

Although you can do useful work just by categorising, describing and sketching, there's a limit to the usefulness of this approach. Imagine that you have returned, sweaty and mud-stained, from the hinterland, notebook and machete in hand, and you're sitting in the captain's cabin, describing the types of forest and swamp to him. Sooner or later you're likely to be asked questions such as approximately how broad and deep a particular swamp is. You could, if you felt so inclined, treat this as a sordidly plebian question, and expostulate at length about the socially constrained nature of measurement, or about the simplisticism inherent in the assumption that one can draw a clear limit to the edge of something like a swamp, but this is unlikely to gain you much respect. A captain of the old school might respond by having you keelhauled for being a smart alec; a captain of the new school might coldly suggest that a rough set or fuzzy set formulation might resolve those particular problems, and then ask whether, for instance, the swamp appeared to have any parts too deep to be waded through. Categorisation can be complex, but fortunately there are some sophisticated literatures relevant to this, so if you have any lingering anxieties you might be reassured by reading up on them.

In field cartography, you can do a lot of useful work with some basic arithmetic; it's much the same in field research, where you can do a lot of useful work by putting some approximate numbers onto things. In the case of Anna's work on criteria for prioritising, for example, an obvious step was to count how many people used each of the criteria.

There are various statistical tests which can be used on results of this sort – simple counts of how many things fit into which categories – and a statistically knowledgeable colleague should be able to advise you on which test will be best suited to your needs.

Changing things semi-systematically: planting coffee bushes

Both the approaches above (describing things and doing some basic counting) are good, solid approaches. They have their limits, though. They just describe things as they are; they don't tell you anything about possibilities for change. Suppose, for instance, that your expedition discovers a new variety of coffee bush growing in the highlands, whose beans produce coffee tasty enough to render a regiment of fusiliers speechless. You realise that this might make your fortune and you decide to try setting up some plantations in a more geographically convenient location. At three of the locations, the seedlings die ignominiously; at the fourth, they flourish and prosper, and soon provide you with enough income to endow a chair in comparative osteology at a leading university.

What you have done in this example is to try changing something and to see what happens. In three cases you got one result, and in the fourth you got a

different result. This shows you that it's possible to grow the new variety of coffee somewhere away from its native valley, and also gives you some rough numbers about how often the move will be successful. A lot of applied research is done in just this way: you try something out in a natural setting and see what happens. The something may be a new method of training staff, or of scheduling tasks, or educating people; for each of these, you'll need to identify different things to tell you what effect, if any, has occurred. If you do this in just one setting, it's usually called a case study; if you do it with a sample of more than one, it's usually called a field experiment.

If the things that you measure consist of discrete categories, as in the previous approach which we described above, then you can probably apply the same sort of statistics based on how many things fell into which categories. If the things that you measure consist of scales (for instance, the height of the seedlings or the weight of beans per bush), then you can use a different set of statistics, but that's another story, described in the next section.

Changing things systematically: moving earth around

Sticking with the coffee plantation example for a moment, the field experiment of raising seedlings in different settings was able to tell you that the bushes could be grown away from their native valley, but it couldn't tell you what made one location suitable and the others unsuitable. This is an obvious problem – for example, what would you do if your one and only plantation was menaced by coffee blight? You might be tempted to list the factors which the suitable location and the native valley had in common, with a view to identifying a suitable location for a second plantation, but that would probably be a long list; most of those factors would probably turn out to be irrelevant, and how could you tell which the relevant ones were? This is where controlled experiments come in.

What you could do is to change the factors in a systematic way and see which of them made a difference. You might wonder, for instance, whether it was something about the soil that made a difference, or something about the climate. What you could then do is ship some samples of soil to several places with different climates, and then plant seedlings at all of these. If all the seedlings planted in the same soil flourish regardless of climate, then that's a pretty strong hint that soil is a relevant factor. This in turn raises more questions, such as what it is about the soil that makes a difference, and you can tackle these questions in just the same way (e.g. if you wonder whether it's something to do with bugs in the soil, you could try growing some seedlings in sterilised soil and others in unsterilised soil).

The key thing about this approach is that you're identifying a factor which might make a difference, and systematically varying it in some way, while keeping everything else the same. This allows you to exclude possibilities in succession and thereby narrow down the set of possible answers. If you do this correctly, then the answer is pretty obvious. You might, for example, give your respondents either a scenario where someone is described as female, or a scenario which is identical except that the person is described as male, and see what differences (if any) you get in the responses. If there are systematic differences

between results from the male and the female scenarios, then the only plausible source of these differences is the wording of the scenarios, since everything else in the study is consistent – if you randomised whether each respondent received a male or a female scenario, then there's no other systematic difference between the two conditions which could explain differences in the findings.

For some research of this kind, you measure the results by counting how many things fall into each category (for instance, how many seedlings fall into the 'died ignominiously' category versus the 'grew and prospered' category). More often, though, you'll be measuring something on a scale (for instance, the height of the seedlings at various ages, or the weight of beans on each bush, or the temperature at which you're growing the seedlings). If what you're doing to the seedlings consists simply of increasing values for one factor systematically and seeing what happens on another factor (for instance, increasing the temperature at which you raise the seedlings and seeing what that does to the height at various ages), then you can probably analyse the results using statistical tests of correlation. If what you're doing to them consists of putting them into separate batches and measuring something about each batch (for instance, the batch grown in peat and the batch grown in loam, and measuring the height of the seedlings every week), then you can use a third family of statistical tests, which deals with measures of variance.

Identifying the things to measure, and the appropriate scale or equivalent on which to measure them, is technically known as 'operationalising your metrics', and is a Good Thing. If you can get the hang of identifying metrics which bear some relation to reality, and ways of measuring them which allow you to ask and answer powerful questions, then the research world lies at your feet.

That concludes this set of extended analogies and metaphors. Research is about answering questions (hence Table 8.1, later); before you get too far into asking questions, it's a good idea to know what types of answer are possible, and for which types of question. The next sections discuss ethics and pitfalls in research design.

Ethics

Ethics are pretty damned important. The trouble is, everybody has a different idea about what is ethical. What we can do is give you a focal concept, introduce an enlightened approach based on principles, say something about background context, and discuss the implications of things that people do in research, so you can think about it for yourself.

Duty of care

The focal concept in research ethics is 'duty of care'. As a principled researcher, you owe a duty of care to a variety of parties, including your predecessors, your research community, your colleagues, your participants and, interestingly enough, yourself. For example, if you're gathering confidential information

from respondents about their most embarrassing experiences, then you have a duty of care to these respondents, which includes making sure that their names remain out of the public domain. If you remember nothing else, remember to ask yourself: to whom do I owe a duty of care, and what is it?

Principles for studies involving human participants

A wise man named John Oates has argued compellingly that "Ethics review is, in essence, the application of informed moral reasoning, resting on sets of moral principles." This translates into taking an approach to research ethics based on principles (and therefore putting responsibility firmly on researchers). Different articulations of principles have been offered, all of them small sets and all with strong commonalities. Here's a set paraphrased from John Oates.[3]

- **Principle 1, compliance with protocol:** research with humans should comply with an explicit protocol (set of procedures) defining how informed consent to participate is sought, gained and recorded, how data is collected, stored and accessed, and how participants are informed of their rights within the study
- **Principle 2, informed consent:** potential participants should always be informed in advance and in understandable terms of any potential benefits, risks, inconvenience or obligations associated with the research that might reasonably be expected to influence their willingness to participate
- **Principle 3, openness and integrity:** researchers should be open and honest about the purpose and content of their research and behave in a professional manner at all times
- **Principle 4, protection from harm:** researchers must make every effort to minimise the risks of any harm, either physical or psychological, arising for any participant, researcher, institution, funding body or other person
- **Principle 5, confidentiality:** except where explicit written consent is given, researchers should respect and preserve the confidentiality of participants' identities and data at all times, as specified in the protocol
- **Principle 6, professional codes of practice and ethics:** where the subject of a research project falls within the domain of a professional body with a published code of practice and ethical guidelines, researchers should explicitly state their intention to comply with the code and guidelines in the project protocol.

You need to find out about your university's ethics review procedures early and ensure that you comply with them. Early, (a) because some institutions (especially those with medical schools) have detailed, time-consuming processes and (b) because ethics review is another useful sanity check on your research design – normally conducted by highly experienced and competent people.

3 Open University Human Participants and Materials Ethics Committee (2006) Ethical principles for research involving human participants, internal document, used with permission. Milton Keynes: The Open University.

In our experience, ethics committees are constructive and helpful, and are on the lookout for risks that you might have missed, including risks to yourself. There's a surprisingly large number of apparently harmless research questions in numerous fields which could quite literally get you killed; it's very easy to get so focused on your research question that you don't think of how differently it might be perceived by others. There's also a surprisingly large number of ways in which human participants can be identified in spite of your attempts to anonymise them in your published work. Ethics committees take these issues very seriously, and can save you from some seriously unpleasant consequences.

One initially frustrating feature of ethics committees is that they will often identify and explain a problem in your research plan, but won't tell you how to fix it. This is because, otherwise, research committees would act as a research methods police, and this isn't a role that ethics committees want. If you end up in this situation, you can arrange a meeting with the committee, and talk through the options with them; you'll probably find them helpful and supportive.

Human participants

There's a line attributed to a German researcher from about a century ago, who allegedly said: 'We must not be anthropomorphic about human beings.' It's a line with more depth than first appears, and is worth thinking about.

However, when you are dealing with human subjects, you have to take into account the effect that your research will have on them. Milgram's experiments into obedience to authority would almost certainly not get past an ethical panel today, because of the psychological effect they would have on subjects who discovered that they were capable of giving someone what they believed to be a fatal electric shock, just because an authority figure told them to do it. That's an extreme example, but useful for making the point clearly.

It's tempting to think that your own research couldn't have that effect on anyone. The trouble is, Milgram didn't think that his research would have that effect. He asked his colleagues, professional psychologists, what his subjects were likely to do. The consensus opinion was that the subjects would refuse to give shocks at quite an early stage of the experiment. Research into humans involves finding out about how they work. People don't often have a very accurate image of themselves, for various reasons. It can be profoundly disturbing to become aware of aspects of oneself which had previously been unsuspected. That's what happened to Milgram's subjects.

There isn't a clear answer to all of this. You need to think it through for yourself. It will make you a better person, especially if you can resist the temptation to fool yourself.

Data management and technology

Clearly, although research ethics is usually discussed in the context of studies involving human participants, this duty of care applies to *all* research. Your

duty of care to conduct your research with integrity and avoiding harm extends to how you conduct yourself as a researcher, including how you report and critique research as well as how you conduct it, how you gather, store and interpret evidence, how you respect and acknowledge your sources, and so on.

One important example is data management: how you store your data, and with whom you share it, has ethical implications. For example, you will need to make informed choices about whether your data can be open source, or whether it is restricted by a contract (for example, if your student contract assigns all of your research data to your university, or you are doing research in industry covered by a non-disclosure or IP agreement) or it must be protected because it includes sensitive information. One pernicious current breach of data security is loss of an unencrypted USB stick containing sensitive information. Universities typically have policies about who owns research data, where it can be stored, and what security measures must be applied.

Similarly, just because 'everyone is using' the latest technology doesn't mean that it is ethical or secure. Digital tools that might look handy (such as cloud storage) must be assessed in terms of vulnerabilities, such as unwanted access to or misuse of data. Researchers need to do their research – checking for hidden risks – before adopting a new technology, so that they can make informed decisions appropriate to their research context.

Tales of horror and how to avoid them

Every research student hears about some tale of hideous PhD disaster. There are many ways of getting things wrong in research. For PhD students, the simplest road to disaster is to ignore, avoid or evade your supervisor. A typical example is the student who sent out a long, badly designed questionnaire to numerous organisations without taking advice (or gaining approval) from their supervisor first. The questionnaire failed to produce anything useful and made the student, the supervisor and the institution look silly in the eyes of a large number of organisations (with attendant impact on job prospects for the student and collaboration prospects for the supervisor). The worst research is usually carried out by students who vanish from sight for months on end, and then hand in something which their supervisor has never seen.

Fortunately, students rarely do research so damaging or dreadful that it is spoken about as a tale of nameless horror. The more common form of academic disaster is doing something so boring or pointless or badly constructed that the examiners can find no merit in it. The following sections cover these issues, and how to avoid them.

Boring, pointless research

It's very tempting, when the time comes to choose your research topic, to go for something that looks easy and safe. So, you cobble together a questionnaire with predictable questions about a trendy topic, send it out uninvited to a large

number of people, a small number of whom reply, and write up the results. No surprises, no challenges – no novelty, no originality; no evidence that you've learned anything in the course of your long, expensive education. A colleague of ours calls this 'stamp collecting'.

'Stamp collecting' tends to have two key ingredients: a conventional approach and an overworked topic. Some questions have already attracted considerable time and attention from other researchers and just doing a similar thing again is unlikely to result in a breakthrough. Yes, sometimes minor details need to be filled in within a research field, and yes, occasionally one of these details unexpectedly turns out to be hugely significant, but in cabinet-making terms, stamp collecting doesn't show mastery. Better options include shifting to a different topic that shares some of the same issues, or asking the same question in a new context, or importing a radically different approach from another discipline – in effect, stepping from the trodden path into an untrodden field.

A useful principle is to think about the 'So what?' question. Say you've discovered that the majority of participants in your gadget design study like blue gadgets better than green gadgets: so what? Does this finding contribute to a coherent theory of aesthetics, or is it just a gee-whiz finding without any further significance? Who is it useful to, besides the gadget manufacturer buying plastic dyes? If you can't answer 'So what?' or the companion question 'Who cares?', then you need to avoid asking that research question in the first place.

So, the effective strategy for a risk-averse student is not to do something obvious or conventional, but to ask their research question in such a way that, *whatever they find, the* results will be interesting and useful.

A neat example is Carmel, a former student of Gordon's who was interested in people's perceptions of Internet banking. The obvious approach would have been to cobble together a questionnaire to ask people what they thought about Internet banking. That had already been done commercially by large specialist companies, so the likelihood that she would discover something new (instead of collecting the familiar stamps) was slight. Instead, Carmel used the findings from those surveys already described in the literature as her baseline. She then took a scenario-based approach, so that she could compare her scenario-based findings to those survey-based results, and assess whether scenarios had any advantages. Scenarios were unexplored in this context, so whatever she found would be useful. She also added a twist. The scenario introduced Chris, who had some money and wanted to decide where to invest or save it. Half the scenarios asked the question: 'What advice would you give him?' The other half asked: 'What advice would you give her?' That one word of difference opened a window onto types of response that a conventional questionnaire would be unlikely to reveal. Female Chris received advice about nice, safe places to save the money to earn predictable returns and avoid losses; male Chris received advice about making a lot of money by taking a few risks with investments.

Seeking supporting evidence for a preconceived idea

It is surprisingly easy to find large amounts of evidence for even the most silly ideas. One exercise we use to demonstrate this to students involves dividing

them into groups, then giving each group the name of a living thing which may or may not be a human (for instance, it may be a kangaroo or an ant). Each group then has to list as many arguments as possible for their living thing being a human being (for instance, that it has two legs, or that it constructs homes), with the other groups trying to guess whether or not they are describing a human.

A frequent version of this problem involves setting out to measure an effect without thinking about (a) whether that effect exists or (b) what the wider context is. For instance, a lot of research by computer science students involves setting out to measure how much better their software is than the previous industry standard; if their software doesn't perform better, they end up with several years' worth of wasted effort staring them in the face.

Asking an unanswerable question

There are questions that, although compelling, are too abstract, too elusive to operationalise or simply far too costly to address effectively. A question may be an important one, but unanswerable. For instance, do different Palaeolithic tool assemblages reflect (a) different activities within the same group or (b) different groups of people, such as different tribes or cultures? Both explanations fitted the facts equally neatly for a long time, until techniques were invented for identifying how tools were used.

Asking a useless question

Just because a question can be answered, that does not mean that it's of any use. For instance, discovering that a particular group of people (e.g. those with low scores on the Smith & Wesson dance test) have particular difficulty in learning foreign languages is unlikely to help anyone who is trying to teach them a foreign language – the teacher will be much more interested in finding out about better ways of teaching them. Trivial studies, addressing questions whose scope is too small to make them generalisable, relevant or interesting to others (e.g. 'Do coloured computer keypads improve student productivity?') are a form of stamp collecting, as are 'one shots' – studies which at best provide 'gee whiz' facts for dinner parties but don't aggregate or contribute to an accumulation of evidence. A well-formed research question will usually have very clear practical implications for someone.

An improbable-sounding instance involves research into flamingo breeding. Captive flamingos are often reluctant to breed. Research indicated that this was because flamingos would only breed when they believed that the flock size was large enough. The practical implication of this was that putting mirrors beside the flamingo enclosure would make the flock appear twice the size, which did in fact encourage the flamingos to breed.

Useful questions about your research

Here are some questions you can ask yourself about your research. If the questions (or the answers) make you angry or nervous, then you should rethink your research design. (Hint: the answer to each question should be 'yes'.)

- Are you trying to find something out, rather than prove something?
- Do you ever find yourself being surprised by what you find in your data?
- Do you ever decide, on the basis of your data, that your previous ideas about an area were wrong?

The three ignoble truths (with apologies to the three noble truths)

Sometimes, a study produces no findings at all, usually through ignoring the Three Ignoble Truths:

- **First ignoble truth:** hardware will break and software will crash
- **Second ignoble truth:** resources won't be there when you need them
- **Third ignoble truth:** people will get sick, die and fail to deliver.

Table 8.1 Finding the right question

Do first things first	There's a reason why experts spend more time planning than novices. Good planning and preparation save time blundering around in the jungle. First, work out what you want to know (refine your question), then work out how you'll know it (the evidence requirements), and *only then* choose techniques.
Work backward from where you want to end up	If you know where you want to end up and work backward from that, then you're likely to get to your goal efficiently. If you blunder off in a random direction, hoping to find a goal, then you're likely to end up lost.
Ask a smaller question	How does one eat an elephant? One bite at a time. If your question is too big, ask a smaller question. A life's work takes a lifetime, but it's achieved one step at a time.
When planning research, aim to reduce the problem space, not to find The True Answer	If you gamble on finding a result, then you're probably doing things wrong. You should phrase your research question in such a way that, whatever you find, it tells you something useful. You should work on the metaphor of the ship's captain making maps of an unknown sea, rather than the metaphor of the ship's captain gambling on finding El Dorado. Knowing that a stretch of sea is empty is just as useful as knowing that there is an island in it. Don't set out to collect data in support of your belief. Ask yourself: 'How could I tell if my belief is wrong?' If you can't answer that question, then you're doing politics, not research.
If bright people have been looking at a problem for more than three years and still don't have a solution, then the solution is probably somewhere unlikely	Two to three years is about the time span for several bright professionals to try the obvious approaches, write up their findings and present them at a conference. If no solutions are being reported after three years, this is probably a significant absence. In this situation, don't rush in trying the obvious approach, especially if the area is a hot topic: do some lateral thinking about different approaches.
Question received wisdom	What 'everyone knows' is often wrong (let anecdote help shape your questions, but then seek independent evidence in order to find answers).
Respect failure	Nils Bohr said, "Science is not 'that's interesting' but 'that's odd'." Great research often comes from surprise. The only bad study is one that doesn't inform you; what information does your 'failure' provide?
Know what can and cannot be shown with different sorts of evidence	Rigour comes from understanding the nature of the endeavour and being vigilant for bias and limitations. Know the value of evidence: not 'good' or 'bad', but stronger or weaker. Know the value and limitations of your tools – for example, sometimes your question will be precise enough for a definitive experiment; sometimes you'll need a different research method. Avoid confusing statistics with rigour: find out what statistics can and cannot do, then go and find a good experimental statistician to consult. Be vigilant about bias; be honest; go and read a good book on the subject.

Chapter 9

Critical thinking

• Research as a discourse • The nature of critical thinking • The role of theory • Style, epistemology and rigour • More about evidence • Giving structure to thinking

You are doing a PhD in a world where different disciplines favour different approaches, value different forms of evidence differently, and make knowledge claims in different ways; a world where you need to sift among the contradictory evidence and ideas to decide which are fatally flawed and which are not. Research is often described as the 'search for truth'; more realistically, it is the search for (increasingly accurate) approximations of truth. How do you discriminate between different approximations? That's what critical thinking is about.

Research as a discourse

Research is a *discourse*, a dialogue involving examination of and reasoning about a particular topic or field. The research dialogue involves an exchange of ideas and often contention and persuasion (it usually, although not always, stops short of bloodshed). It is the negotiation of knowledge or understanding (cf. Foucault). What is a thesis? A premise maintained or promoted in argument. In brief, an argument.

That's why (after all these centuries) a PhD culminates in the submission and defence of a dissertation: it is the active demonstration of competent engagement with the discourse. By publishing, discussing and defending, we are:

- Engaging in the discourse – 'negotiating new knowledge'
- Presenting a thesis which is founded in evidence (new or existing) and argued soundly

- Not just generating results, but defending them robustly so that they have an impact on the discourse – and change the state of knowledge
- Not just having ideas, but communicating and defending them
- Most importantly, exposing our research to the scrutiny of our peers – and so exposing it to challenge and falsification.

This 'negotiation of knowledge' is why passing a PhD requires both rigour and rhetoric. As one colleague phrased it: 'do good work, tell a good story'.

Rigour

Rigour is vigilance against bias, manifest as disciplined practice and reasoning. It involves:

- Systematic investigation, purposeful, focused activity and gathering evidence in order to produce helpful/useful output to answer a question, or to solve a problem
- Conforming to standards of practice in the discipline
- Founding research in and relating it to existing knowledge
- Providing insight/understanding into a particular subject by offering new analysis (identifying and addressing gaps, identifying key factors, patterns and relationships) or new synthesis (gathering knowledge and reasoning over it to produce new knowledge)
- Offering only well-founded conclusions, based in evidence
- Appropriate, self-critical analysis
- Generating 'reliable' knowledge.

Rigour is necessary, but it isn't enough on its own; rigorously doing the wrong thing isn't likely to get the right result.

Rhetoric

Rhetoric is the art of communication and persuasion. Ideally, effective academic rhetoric involves:

- Using language effectively to convey ideas, to influence, to persuade
- Honest reportage: clear descriptions of what has been done
- Clear communication of processes, results and ideas
- Systematic argument – with a clear and explicit chain of reference
- Anticipating and addressing alternative perspectives and alternative accounts.

There is no point in producing great results if they're not communicated well. Swiss physicist Ernst Stueckelberg missed out on at least one Nobel Prize because he published his theory about how light interacts with atoms in an

obscure Swiss journal, with the result that his work was overlooked when the panel was handing out prizes.

The nature of critical thinking

Critical thinking is about curiosity, about continual questioning. It is also about developing a healthy, deliberate, 'mindful' scepticism and applying it even-handedly to all aspects of your research. Critical thinking is why 'the only stupid question is the one you didn't ask', because nothing is exempt from scrutiny. It's like combining the intellectual licence of a two-year-old with the intellectual power of a forensic accountant.

Critical thinking is the basis for rigour. It's not about strict observance of procedures or strict enforcement of rules, since those procedures may be wrong or inappropriate for what you're doing – adherence isn't enough without understanding, and researchers march readily into pitfalls via unthinking application of procedures. Naive researchers who put techniques before questions are in danger of conducting what Richard Feynman identified as 'Cargo Cult Science'[1] (referring to the behaviour of certain Pacific island peoples, who built runways in order to tempt aeroplanes to land and deliver cargo) – mistaking scientific method or statistics for rigour *per se*, without understanding the roles of observation, reflection, scrutiny and critique in maintaining the scientific 'attitude of mind' and working mindfully with theory. Taking procedures and rules for granted is just as dangerous as taking assertions for granted.

Critical thinking is not about learning a set of eternal truths, since research involves constantly updated best approximations. It's about asking good questions, and following them up; asking the question that comes *after* your research question, and the question after that. It means not stopping at the first predicted outcome or first set of data, but asking 'So what?' It means thinking about the implications of your findings. What does this result mean? What are its consequences? What are its limitations – what more do we need to know?

The 'substance of research' isn't just data and variables, and the business of research isn't just hypothesis and observation – more than that, research is based in ideas and reasoning, in reflection and critique, and in dialogue among researchers with a common aim of explaining the world. Theory is a vehicle for that dialogue.

The role of theory

Findings on their own may be interesting, but they don't offer explanations. That's where theory comes in. It is our attempt to provide usable, general explanations

1 Feynman, R.P. and Leighton, R. (1985) *Surely You're Joking, Mr. Feyman!* New York: W.W. Norton.

for phenomena in a way that accounts for both the visible and the hidden factors, that generalises across situations or events, and that ultimately accounts for causality and allows us to make predictions about the phenomena. Theory tries to answer 'Why?' as well as 'What?'

It's useful to think broadly in terms of a 'method of science',[2] an approach to inquiry based on systematic reasoning and empirically based evidence. 'Method of science' is a process of theoretical and empirical reasoning, rather than a specified empirical strategy. It is characterised by principles such as articulation, validation, exposure to falsification and generalisation. 'Method of science' views 'scientific method' as just one way among many of gaining knowledge. It respects the roles of both inductive reasoning and deductive reasoning in the give-and-take between empirical investigation and theory. Inductive reasoning (arguing from the particular to the general) emphasises the identification of regularities. It is a way of generating theory and of asking better (more informed, more focused) questions. Deductive reasoning (arguing from given theories, models or axioms to make statements about the behaviour of particular cases) emphasises hypothesis-testing. It is what drives scientific method, making and testing predictions and considering the adequacy of proposed 'answers'.

This broader view values description – witnessing the world – as well as prediction and hypothesis-testing. It sees the relationship between theory and evidence as a dynamic, two-way give-and-take. It embraces both theory-driven (deductive) and data-driven (inductive) investigations. Deduction tests the predictions or hypotheses derived from a theory in ways that allow them to be disproved; it draws inferences from observations in order to make generalisations (in order to generate empirically grounded theory which may or may not subsequently be subject to deductive approaches).

Scientific method revolves around theory: scientific inquiry produces predictive theory which generates hypotheses that can be falsified. But where does theory come from? With 'method of science' we recognise that the process of articulation – making phenomena explicit in sufficient explanatory detail – is a crucial part of research and of theory generation. We need to articulate assumptions, meanings, constructs and their relationships in order to help clarify what we think we know and how we think we know it. We're offering different accounts of 'what' and 'why' – and we're offering evidence to justify choosing among the competing accounts. We're making best estimates and reasoning about the probability of error.

Theory is a way of focusing our thinking about why things are as they are. Falsification allows us to eliminate some theories, but we can't be sure that what survives is a 'true' theory – just that it's theory that hasn't been disproven yet. We work with 'best approximations', in which we have more or less confidence, depending on what evidence supports them.

2 This argument was first presented in Fincher, S. and Petre, M. (2004) A preface to pragmatics, in S. Fincher and M. Petre (eds) *Computer Science Education Research*. London: RoutledgeFalmer, pp. 9–17. Used with permission.

Style, epistemology and rigour

An example of this broader view is the divide in most areas between 'neats' and 'scruffies'. The 'neats' concentrate on formalisms to provide clean, abstract descriptions of the area; the 'scruffies' concentrate on understanding what is actually going on, even if they can't express it very neatly. Relations between the two groups usually vary between cool disdain and bitter feuding. 'Neats' typically have more academic street credibility, because they typically use intimidating mathematical representations. 'Scruffies' typically have more credibility with industry, because they typically have a wonderful collection of 'war stories' and know just what sort of things go on when the Health and Safety people aren't watching. Some people straddle the divide and have both a wonderful fund of stories and the ability to use intimidating representations.

There is a spectrum of research types ranging from formal to informal. At the formal end of the scale are abstractions – for instance, mathematical modelling of an area, or trying different representations of the same topic.

Next along the scale is the formal controlled experiment, straight out of the textbook – for instance, comparing the responses from two groups which you have treated in different ways. For this, you will know which variables you are manipulating and which you are measuring; you will have thought carefully about sample size.

Around the middle of the scale is the field experiment, where you are not able to control all the variables that you would like to and are trading that off against the realism of experimentation in the outside world. For instance, when redecoration time comes round, you might manage to persuade your establishment to paint the walls of one computer room a tasteful shade of green to see whether this calms down the users and reduces the number of complaints they make about the computers, compared to the users in the standard-issue hideous orange rooms. For this, you will know which variables you are manipulating and which you are measuring, but you will be horribly aware that other variables may be scurrying around looking for somewhere to cause you trouble.

At the scruffy end of the scale is the collection of squishy observational data with a very small sample size. A good example of this is the eminent sociology professor who allegedly studied tramps via participant observation (i.e. passing himself off as a tramp and socialising with them). The result can be extremely interesting insights into an area, plus data that nobody else has, plus clothing that smells of methylated spirits.

Epistemology and rigour

Fundamentally, the divide between 'neats' and 'scruffies' has to do with what their goals are, what sorts of evidence they prefer, what their criteria are for rigour and what level of error they're willing to tolerate. In other words, it's epistemological. Epistemology is to do with what we believe constitutes 'knowledge', how we can know something is 'true' and how we share that knowledge. By defining the grounds for knowledge, epistemology sets out which knowledge claims are

legitimate. By implication, it also sets out what *questions* are legitimate (or even allowable): what kinds of questions can be – or should be – asked, and how we go about answering them.

Different disciplines have different systems of creating, understanding and communicating knowledge, which are not necessarily transferable to other disciplines. For example, we can't apply the way astrophysicists theorise about and investigate the creation of the universe to the way educators develop and deploy pedagogies in primary schools. The questions are different, the 'burden of proof' is different and the way evidence is discussed is different.

One thing to remember about evidence is that some aspects of it are social constructs and others aren't. The proportions vary. In the physical sciences, for instance, heat is clearly something which exists independently of human belief systems – there were hot things in the universe long before the first hominins wandered across the world, and there will probably be hot things long after the last hominin is dead. The systems which we use to measure heat, though, are social constructs: the instruments are based on what humans can perceive or can imagine perceiving. At the other end of the spectrum, concepts such as 'bravery' or 'good taste' are found in most human societies, but are pretty much entirely human creations which are mapped onto different behaviours and different abstract concepts by different societies. Even when there's reasonable consensus about an area, it's normally necessary for human beings to adopt a simplified version of it, since the human brain couldn't cope with the information load of trying to handle every specific instance and bit of evidence relevant to an issue.

Each discipline has its own standards of rigour, its own conventions of evidence and argument which members of that discipline – and of that discourse – must understand. Learning the tools of the trade involves learning not just the methods but also the disciplinary context, the knowledge concerns the methods were designed to address, and the associated assumptions and limitations on use.

There can be multiple ways of studying a phenomenon, but that doesn't mean 'anything goes'. Each study must be rigorous in its own terms.

Truth

Validity (or 'truth') in research involves a combination of factors, including the accuracy of our observation, the quality of our reasoning, and the completeness of our explanation. Rigour is the systematic pursuit of validity through disciplined practice and reasoning. Truth, according to the author Jack Vance, is a precious jewel, the more precious for being rare. It is not a researcher's job to keep the price up by keeping the supply down.

Researchers have various ways of trying to establish validity, all bound to critical thinking and the research discourse. Two of these are *replication* and *repetition*, both of which address the reliability and robustness of the findings, and also expose the study design and conduct to the scrutiny of more minds. Replication is the reproduction of a study by another researcher, using the same protocol under the same conditions. Replication tests how 'reliable' the findings are – that is, how consistent outcomes are when the study is repeated '*verbatim*'.

Replication is the standard for laboratory experiments, but is not necessarily feasible in human studies research because social environments are by their complex and changing nature difficult to control and reproduce. As a result, repetition is the standard for human studies: reproduction of a study by another researcher, using a closely comparable protocol under comparable conditions. Repetition tests 'robustness', how consistent the outcomes are across different related tasks, different related environments or different related contexts.

However, as any social scientist knows, truth is a tricky and relativistic thing to pin down. There are good grounds for arguing that truth in the strictest sense is a meaningless concept. A neat way out of this is to argue that there is an asymmetry, derived from the mathematics of infinity. There is an infinite set of propositions which correspond with a given slice of reality and can therefore be described as 'true'. However, this is not the same as saying that all propositions are equally true and valid. There is a different and also infinite set of propositions which do not correspond with a given slice of reality and can therefore be described as 'not true'. So, how can you decide whether or not a particular explanation is demonstrably untrue, and how can you choose between those explanations which are consistent with the facts?

If we look at the explanations consistent with the facts, we will usually find that they vary in their neatness of fit. The normal convention in research is to adopt the simplest explanation which maps onto the most facts most neatly; as you might expect, this leads to debate about which explanation fits this description most accurately from among the candidates. This approach is also the basis of falsification: you propose an idea, test it out as hard as you can and see whether any of the tests show it to be false. If not, then it's a candidate for an adequate explanation, at least until a better one comes along.

More about evidence

Critical thinking accounts for the difference between 'data' and 'evidence'. Data is not necessarily evidence – it becomes evidence when its relevance to the question is established. Therefore, the quality of evidence lies not just in the quality of the data but also in the quality of reasoning about the data.[3] Evidence interacts with theory; a good theory makes better use of data (and does a better job of organising it into evidence) than a poor theory, while bad data make it more difficult to produce good theory.

Operationalisation (or, getting useful data)

In order to design empirical research, we must map from the question to the evidence needed to answer it, from what we want to know to what we can observe in the world. This mapping is called 'operationalising'. The validity of

3 Paraphrased from Mislevy, R.J. (2001) Basic concepts of evidentiary reasoning. Available at: www.education.umd.edu/EDMS/EDMS738

a study depends on the link between idea and observation: between a construct (your concept or notion of the thing of interest) and what can be observed, recorded and ultimately measured in some way. Usually, this is a simplification; the process of operationalisation selects one or more observable aspects of the phenomenon to focus on and capture. The observation or measure is a sort of proxy which stands for the construct. But the things we capture – recordings, descriptions, categorisations, measures – are not the phenomenon. If the reasoning that links the question to the evidence, or the proxy to the construct, or the measure to the phenomenon, is faulty, then the data may be irrelevant or misleading.

Researchers are often distracted from what *should* be observed by what *can* readily be observed. The dangers of errors in operationalisation are summarised neatly in a process called the 'McNamara fallacy', after the US Secretary of Defence who quantified the Vietnam War:[4]

> The first step is to measure whatever can be easily measured. This is OK as far as it goes.
>
> The second step is to disregard that which can't be easily measured or to give it an arbitrary quantitative value. This is artificial and misleading.
>
> The third step is to presume that what can't be measured easily really isn't important. This is blindness.
>
> The fourth step is to say that what can't be easily measured really doesn't exist. This is suicide.

Representativeness and generalisation

Empirical study involves selection. We select a sample to represent a population. We select a task (or a small number of them) to represent a repertoire of activities. We select a setting (or a small number of them) to represent an environment. We select observations and measures to represent a phenomenon. And so on. Selection entails an obligation: to consider whether whatever you selected represents accurately what it was selected from – the population, repertoire, environment, etc. it was meant to typify. A considerable amount hinges on the answer. If the selection is too particular, too idiosyncratic, or in some way not representative, then the findings are limited to that selection. The legitimacy of any general claims you make is based in the representativeness of your selection. Representativeness (the ability of a specific instance to stand for the larger group of which it is a member) is the key to generalisation. If the selection, and hence the study, is representative, then the study's outcomes can be generalised to the greater population, to other related tasks, to the greater environment, and so on.

4 The expression of the fallacy is attributed to Daniel Yankelovich in 'Adam Smith' (George G. W. Goodman) (1981) *Paper Money*. New York: Summit Books, p. 37. The McNamara Fallacy is also quoted in Charles Handy (1994) *The Empty Raincoat*. London: Hutchinson, p. 219.

Models

'All models are wrong, but some are useful.'[5] A model is a schematic (hypothetical) description of a phenomenon (typically of something that cannot readily be observed directly) that accounts for its properties or behaviour. Good models are 'parsimonious' – as simple as possible while still describing the important features of the phenomenon and being consistent with the data. As such, they select (choosing which are the important features), abstract (addressing the essence while omitting detail) and simplify (focusing on selected features of a complex problem). The parsimony is what makes them useful; they reduce a complex phenomenon to a manageably small explanation, which lets you make useful predictions. The parsimony is what makes them potentially dangerous; if you emphasise the wrong features or abstract away the wrong details, then your model becomes misleading. There are a lot of scientific aphorisms to the effect that a model should be as simple as necessary, but no simpler.

Models take various forms. Often models are based on analogy. Sometimes they are mathematical representations of a situation that support formal inference. Sometimes they are conceptual – an abstract representation of how concepts fit together. Sometimes they are structural depictions of a physical system. Sometimes they are procedural descriptions of a process or interaction. Their role is to simplify the complex and make it manageable, to make a generalisation concrete by representing it graphically or symbolically, to reveal possible relationships between important variables.

Accounts of phenomena (whether informal analogies or mathematical models) are generalised explanations.

Comparison and analogy

Very often, models are based on an analogy – for example, an atom is like a solar system, with the electrons orbiting the nucleus. In every analogy some things are the same – but some things are different. The true power of analogy in critical thinking lies not so much in the similarities but in the differences. Understanding the ways in which an atom is *not* like a solar system provides crucial insight into defining and distinguishing characteristics.

Statistics and uncertainty

Statistics is a scientific tool for reasoning about numerical data and for modelling uncertainty. It is not a magic bullet. Using statistical methods well requires understanding, attention to context and critical thinking, not just formulaic application of techniques.

Roughly speaking, statistics is about working out the signal-to-noise ratio: establishing whether variations in data are meaningful (signal) or just chance

5 Box, G.E.P. (1979) Robustness in the strategy of scientific model building, in R.L. Launer and G.N. Wilkinson (eds) *Robustness in Statistics*. New York: Academic Press, p. 202.

fluctuations (noise). And it is about working out if the 'noise' results from natural random variability or from error. Statistical tests model uncertainty. They provide a probability that a set of results is due to random variability – and arguments are made on the basis that the less probable it is that differences are due to random variability, then the more probable it is that there is a significant effect (signal rather than noise).

That's why good application of statistics requires an initial, critical examination of the data: for assessing the structure and quality of the data, for summarising the data and picking out interesting features, and for helping to identify an appropriate further analysis strategy. What's the quality of the data: are there errors, oddities, missing observations? What's the nature of the data: how large is the sample; how many variables are there and of what type (e.g. continuous or categorical); what's the distribution of the data; what's the spread; what's the precision?

Often, that's enough – the initial exploration provides all the evidence required to provide concise descriptions of general trends and patterns. Enough to compare new results to previous results. Enough to identify interesting differences and enough to make clear that the data is too 'dirty' to sustain further analysis.

Bias

Bias is when beasties creep in unnoticed to corrupt the evidence, when results are distorted due to factors that have not been taken into consideration. There are lots of 'beasties' lurking (e.g. extraneous or latent influences, unrecognised conflated variables, selectivity in a sample which renders it unrepresentative). The very act of experimenting introduces the potential for bias. This is referred to as the Heisenberg, or uncertainty, principle: you can't observe without influencing what you're observing. Observing phenomena changes them.

Bias can creep in at any point in research, and can take many forms: experimenter interference (in the data); projection (in the ways questions are framed, in the analysis); limitations of human reasoning (e.g. confirmatory bias); theory (theoretical ideas influence the selection and interpretation of evidence); the sample (improperly selected, too small to permit any reliable conclusion, not representative); participants (who may deliberately or unwittingly alter their behaviour or responses); design; conditions; apparatus; reporting . . . bias is unavoidable, but it can be addressed and reduced.

Bias distils into two things: the framework within which you're operating, and the trustworthiness of your findings.

You can't tackle any question without a framework. For example, the question of whether dogs are better pets than cats is embedded within a whole set of assumptions, such as the concept of 'pets'. In some belief systems, having pets is normal; within others, the meaning of 'pet' is not the same as in Western Europe; within others again, having pets is immoral. You can't ignore or escape this type of framing. If you treat all three of these belief systems as equally valid, that in itself is a value judgment. In this sense, the idea of avoiding bias is meaningless.

Then there's the issue of how much people can trust your findings, and why. Even if you're legendary for your integrity and honesty, you'll still be liable to cognitive biases which will nudge you in the direction of your preconceptions. This can be reduced to at least some extent. Good research methodology is good because it reduces the opportunities for those nudges. Replicability is a tool for increasing trust; if other researchers find the same that you do, then the results are more trustworthy.

However, trust isn't everything. The questions you ask, and the tools you use, will constrain what you can find. This takes us back to the framework within which you operate, and back to a more nuanced awareness of research as an ongoing process of developing the best models we can manage with what we have, rather than as a process for mining nuggets of eternal truths.

Giving structure to thinking[6]

One of the keys to critical thinking is make the thinking explicit. Externalising and representing thought makes it available to scrutiny, both by the thinker and by others who might engage with the ideas.

The brain dump

One of the interesting challenges of writing is to force complex thought into a single line of narrative. It's difficult. Writing coherent academic prose demands order, prioritisation, clarity and specificity. Thoughts don't work that way. They're fuzzy and joined in a loose network, not crisp and linear like text. There's a reason why backs of envelopes and whiteboards persist as the tools of choice for many creative endeavours – they're all better suited to representing thoughts. Visual tools like sketches, mind maps, structured diagrams (such as flow charts, time lines, decision trees, etc.), tables, and so on can all help to externalise thoughts and then begin to organise them into a form suitable for communication. The process of representation is part of thinking; it helps to focus and specify ideas, and externalising thoughts allows the thinker to examine and interrogate them differently, creating a sort of dialogue between thinker and represented thought. Sometimes the process is more important than the product, revealing questions or assumptions that require further investigation; you throw away the envelope or clean the whiteboard once they've done their job. Sometimes the product has value and is worth communicating to others; you work up the diagram into a figure for your article or thesis.

6 This section is informed by and draws from the Open University's Learning Space study skills site on 'Extending and developing your thinking skills'. Available at: http://openlearn.open.ac.uk/course/ view.php?id=1644

Assumptions

Assumptions are things (facts, axioms, constraints, conditions, etc.) we often overlook or take for granted. Critical thinking demands that we look again. Assumptions can have the advantage of making a problem more manageable by simplifying that problem and reducing the problem space. Sometimes we make assumptions explicitly, but more often assumptions are hidden or unnoticed until we make a deliberate effort to identify them – and of course it's usually the hidden assumptions that impede progress. Exploration of assumptions plays a crucial role in critical thinking, exposing constraints (inherent or imposed) and beliefs (including what constitutes a 'good' solution).

Assumptions also condition our expectations, sometimes in ways that create unnecessary obstacles. For example, a student learning to write computer programs was given an assignment to read an existing program, about a page or two long. She began, and then stopped: 'It can't be this hard,' she thought. She consulted a friend, an expert programmer: 'Can you show me how to read this program?' 'Sure,' he said, and proceeded to read the code line by line over a substantial period. She sat aghast: 'If I'd known it was just hard, I could have done it myself.' Tasks are easier if they're begun with accurate expectations.

Write down your assumptions. Prioritise them: which have the greatest impact? Which do you consider immutable? Group them into types: which are defining assumptions? Which lead to constraints? Which are make-or-break? Which are about values? Examine them critically. Is each necessary, or not? What if one of the crucial assumptions could be removed? (Experts innovators think this way, posing questions like: what happens if we remove gravity?) Examination of assumptions can (a) save you from embarrassing and time-consuming oversights and occasionally (b) transform your thinking about your research question or research design.

Applying structure

Generating lists and piles of ideas is one thing. Putting them in order, identifying structure, seeing the overall message as well as the individual items, is quite another. That's where disciplines of thinking come in, to help you consider ideas systematically, from different perspectives (including the Big Picture), and from that to assess relative importance and identify relationships and patterns. The next step is to apply structure, whether by identifying and drawing out relationships in the ideas, by building a framework of emerging concepts, by mapping the ideas onto a model or by imposing a structure from the literature.

In any case, what's needed is an 'organising principle' (or a series of them), a basis and a focus for bringing order. Hierarchical structures can be useful – stratified tree structures based on priorities, contingencies or dependencies. Distinguishing between the general and the particular can help draw out structure. Information or resource flows can be an organising principle – for example by analogy to the inland waterways system, with canals and rivers interconnecting into a transportation system across a landscape, and locks and elevators overcoming disparities of level and helping to manage the water flow. Other

organising principles might include: organisational structure, geography or other spatial organisation, conceptual location (e.g. position in an argument), chronology, complexity, pros and cons, 'known-ness' – the degree to which ideas are understood and substantiated – methodology, sources or social structure (grouping ideas by who or which community originated them and hence structuring in terms of 'schools of thought'), and so on.

Try different organising principles, different groupings and different representations. Writing ideas on Post-it notes or index cards can help, allowing you to shuffle them and deal them out or regroup them physically.

Problem-solving techniques

A number of systematic step-by-step processes for thinking about problems and solving them have been articulated. (DeBono, Polya and TRIZ leap to mind as examples.) One typical (and brief) example is DANCE:[7]

D – Define and clarify what the problem really is. What are your goals?
A – Think of alternative ways of solving the problem
N – Narrow down the range of possible solutions
C – Choose the ideal solution and check what the consequences might be
E – Effect action using the best solution.

Different perspectives

There are lots of places to look for ways to extend your repertoire of thinking tools: literatures on problem-solving, rhetoric, design and innovation, creativity, soft systems, etc. Here's a selection of techniques for considering different perspectives and thereby seeking critical balance in your formulation of arguments.

- Devil's advocate: adopt alternate points of view, one supportive and one hyper-critical, and argue the case
- PMI: identify *plus* (advantages), *minus* (shortcomings) and *interesting* points[8]
- Force field analysis: list forces acting for and against a change
- Inverting propositions: don't just consider your proposition or hypothesis; consider its inverse and its converse (e.g. if you're thinking 'does feminist discourse reduce smoking?', then consider 'does smoking inhibit feminist discourse?')
- General and particular: consider your proposition or argument at different levels of granularity, from the general case to particular, concrete examples

7 Rose, C. and Nicholl, M. (1997) *Accelerated Learning for the 21st Century*. London: Piatkus.
8 de Bono, E. (1992) *Serious Creativity: Using the Power of Lateral Thinking to Create New Ideas*. New York: Harper Business.

- Rival perspectives: have more than one account, perspective or hypothesis and test each systematically against the available evidence (tables can help here). What does each account give you that another doesn't and which accounts for the evidence better? Which offers better insights?

Critical thinking is not just about making a particular argument. It's about considering issues from all perspectives, in order to produce a balanced argument, and draw robust and defensible conclusions. It's about seeking truth.

Chapter 10

Writing structure and style

The dissertation is the piece of written work which shows that you have the skills and knowledge required to make you worthy of a PhD, such as being able to design, conduct and publish an original piece of research. A key word is 'shows'. You need to know what the relevant skills and knowledge are for your field, and then make sure they are visible in what you write. Recalling a quotation from a previous chapter: 'Do good work, tell a good story.'

Getting the form and voice of the dissertation right is just as important as getting the content right – indeed, they're essential to conveying the content. If you doubt this, remember the ground rules: a dissertation should stand on its own – if the examiner misunderstands it, then that's the candidate's problem, not the examiner's.

How can you tell a good story? What constitutes 'good academic English'? How can you send out the right signals with your writing, and avoid sending out unintended wrong signals? This chapter and the following chapters deal with these issues, the structure and style of academic writing, the process of writing (e.g. coping with writer's block), and different forms of publication.

Finding the plot

One sobering thought for most PhD students is the sheer size of the dissertation they will have to produce. It will probably be the largest single piece of written work that the student has ever written. Most students are understandably

intimidated by this. At one level, the structure and style for writing up a PhD dissertation are straightforward. You simply follow the standard structure used in your discipline. At another level, the dissertation is meant to report a considerable amount of material: literature, theory, methods, evidence. Structure, style and content are inextricably intertwined. That's a lot to make sense of, and it makes it much more difficult to keep a clear overview of the entire document in your mind, and much more difficult for the readers to keep a clear overview of the entire document in their minds.

So, what can you do about this? Change perspective. Instead of looking at the collection of material you need to report, step back and remind yourself of the Big Picture, your thesis, the core argument you're trying to make. As is often the case, it helps to work backward. Start by thinking where you want to end up: imagine the finished dissertation, and the conclusions it reaches. Then work backward from that destination, identifying major components, sorting out critical paths to those components, and so on until you find a place to start. By mapping out your terrain and then plotting a path through it, you demonstrate that you have high-level skills, involving the ability to grasp complex theoretical concepts and empirical evidence, to structure them, and to write about them in a way that demonstrates your mastery of them. This involves a balancing act between clarity and complexity. Fortunately, there are ways of doing this. Two good ways involve fairy tales and a highlighter.

Fairy tales

A good PhD has a good plot, and that plot is identical to the classic plot of a fairy tale. This is no accident. One key feature of a plot is that each action should arise as a logical consequence of other parts of the plot; another key feature is that the plot centres around a protagonist trying to solve a problem.

A classic plot starts with a dragon appearing and laying waste to the land. Various knights try to defeat the dragon, but fail. Then the protagonist enters the scene, having found a magic weapon. The protagonist takes on the dragon and defeats it. The protagonist is rewarded, and there is a happy ending.

It's the same in a PhD. There's a practical or theoretical problem (the dragon), which you describe in your introduction. Various researchers (knights) try to solve it, but fail, which you describe in your literature review. Then you encounter a possible solution to the problem (a magic weapon), somewhere in your literature review and/or your evidence gathering. You take on the problem; what happens is your results section. You either defeat the problem, or escape and report on why the possible solution didn't work; this is your discussion section. You then decide whether to settle down and live happily ever after, or go on to further adventures; that's the conclusion and further work section. The technical details about your proposed solution go into the appendices.

The key thing about this classic plot is that there's a clear narrative spine throughout, a connected sequence of elements, each leading to the next. Everything that you are doing is there for a clear reason. This makes it much easier for the reader to follow what you're doing, why you're doing it, why you're

doing it this way, and what the implications are. Swedish academics use the image of a 'red thread' running through the text (like a red thread woven through plain muslin) as a metaphor for this narrative spine. The red thread provides clarity about what's important and what's peripheral. Another way to think about it is that all the elements of your dissertation must ultimately contribute to the Big Picture; any work that doesn't contribute to it should be left out. If you continually reassess the Big Picture and the red thread that runs through it, then you'll be in a good position to make a coherent account of your work.

The highlighter

As for the highlighter, that's useful for balancing the tension between clarity and complexity. One simple but effective way of achieving this balance is to think of each paragraph as consisting of one topic sentence, plus several content sentences. A typical topic sentence will be something along the lines of: 'A core problem in X is Y.' This is simple and clear, but it involves knowledge that is at PhD level; it's not just a statement of the obvious. A typical content sentence will then unpack the topic sentence in detail, with facts, figures and references.

This combination lets you achieve the balance between clarity and complexity. For some students, this is something that they've known how to do since they were ten; for others, it's a major revelation. If it's new to you, you can practise it by highlighting your topic sentences. That lets you see at a glance whether you're getting the balance about right. It also lets you read the topic sentences one after the other, so you can check whether they're showing a coherent and compelling plot.

Finally, a reminder that suggestions about how to organise your literature and ideas are in Chapter 6 – the section on Organising the literature – and Chapter 9 – Giving structure to thinking. In the following sections, we'll unpack what's involved in turning these principles into text.

Structural components of a dissertation

Once you have your thesis clear in your mind (the argument that you're proposing, together with its reasoning and evidence), then everything else should follow; the chapter structure should emerge naturally. The guidelines of your institution and your discipline will help with the standard structures and expectations. It's helpful to read other dissertations, and to consider what they do well (so that you can emulate effective writing) and what they do badly (so you can avoid their mistakes). Keep a file of good exemplars – theses of the structure or style you'd like to achieve – for reference when you're writing.

The following sections identify considerations that you may find useful in understanding the roles of different dissertation elements – and hence how to structure your content for your dissertation. (They are not a prescription for the structure or chapter order, which must follow your 'red thread'.)

Chapter titles, section headings, etc.

A good test is to look over the table of contents of your thesis to see how much a reader can anticipate about the research just by scanning the headings. Headings are crucial in 'signposting' the narrative for the reader. Some useful questions to ask yourself about the table of contents are:

- Where is the methodology described? Can you tell what was actually done in the research?
- Where is the evidence presented? Can you tell what kind of evidence it is?
- What is the approach or stance adopted for the work?
- Is a new model or theory presented?
- What is important about this research? What is new?
- What are the conclusions?

The research question

This is the central part of your thesis; it is horribly easy to forget to state the research question explicitly, precisely because you are so familiar with it that you cannot imagine anyone else not knowing it. Some things to ask yourself are:

- Where does the statement of the specific research question occur in the introductory chapter (i.e. how long does the reader have to wait to discover what the particular focus of the dissertation will be)? Is there a one-sentence or a one-paragraph statement of the thesis?
- Is the statement of the research question clear and concise?
- Is the statement of the research question phrased as aims, objectives, questions, goal, problems to be solved, challenges to be addressed – or in some other form?

Theory and evidence

Theoretical context provides the rationale for your work; evidence underpins your claim to have made an original contribution to knowledge. You might want to ask yourself the following questions:

- How is theory presented in the dissertation?
- How is theory used in the argument?
- Is it clear what theory the research relates to?
- How well is the design of the research related to its theoretical underpinnings?
- Is it clear how the research contributes to theory in the domain?
- What are the proportions of theory and evidence?
- Is the evidence presented objectively?

- Are the premises and assumptions stated?
- Are the methods described in a way that allows replication/repetition?
- Is the interpretation distinguished from the presentation of the data?
- Does the interpretation-as-evidence follow from the data?
- Do the conclusions follow from the evidence?

Introduction

This is where you should (a) create a good first impression and (b) show your reader that there is a good reason for your spending several years of your life researching this topic. Typical ingredients of an introduction are:

- Statement of problem/question
- Broad rationale for problem/question
- Critical description of relevant literature (including schools of thought which disagree with your own)
- Explanation of language and terminology (if needed)
- Aims, goals, objectives
- General statement of findings
- Description of, and rationale for, the research approach
- Plan for the remainder of the dissertation; overview of the argument.

Literature review

Dissertations (and academic papers) normally begin with a literature review to set the scene. This must be a critical review of the literature, as opposed to simply reporting it. Its aims are:

- To frame your research (setting it in the context of existing theory and prior research, showing how your research question is motivated, and showing why your research is needed and significant)
- To distinguish your research from other work
- To show clearly to the reader that you know your subject thoroughly.

Given that the literature review will frame the research, it makes sense that it should be presented at the *beginning* of the dissertation. Many dissertations add additional, specific references throughout the work – for example, elaborating a technique or providing corroboration or contrast within a discussion section. Often, the research methods references are introduced in the empirical studies chapters as they become relevant. Some distribute the literature review throughout the dissertation on an 'as needed' basis, in effect providing an introduction and literature review for each major part of the research – this can be effective, but is also risky. It is unusual and inadvisable to leave the literature

review to the end (such a dissertation would not normally be considered to be well written).

The review should contain:

- An arguably comprehensive/representative collection of literature
- Seminal papers
- Selective papers relating strictly to the focus of the thesis.

The range of literature needed is discussed in Chapter 6, as is the desirable number of citations, and the required range of publication dates. The key to the literature review is establishing a well-founded base of about 50–150 papers on which you can draw reliably.

Your description of what is in each paper you cite should be distinguished from your interpretation of it. You should continually ask yourself whether you've slipped into just reporting the literature, or whether there is analysis and sense-making. A good literature review 'adds value' by mapping the territory; identifying patterns, trends and gaps; identifying key concepts and unifying terminology; providing consolidations of information (e.g. tables, models, maps) from a number of works that facilitate comparison and sense-making.

Tables and their uses

Tables can't just stand in isolation – they must be described in the narrative and *relate to it*. Remember to check that the tables are labelled in the required format, and that they are labelled consistently. Common uses are:

- Summary (e.g. of results, statistical analysis, literature)
- Comparison (e.g. a comparison of research methods and outcomes across a number of studies)
- Providing context and assisting navigation (e.g. through a line of argument, through the dissertation)
- Establishing categories and establishing what those categories include
- Providing a framework (e.g. for ideas and their relationships or for techniques and their applications).

How to Lie with Statistics gives a good overview of sins to avoid in your tables (see 'Some further reading').

Illustrations and their uses

Illustrations/images too must be described in the narrative and relate to it. The order is straightforward: introduce the relevant concept; refer to the image to come; insert the image, labelled informatively; in the next paragraph build on what is shown in the image to your next point. The image must have a role in the argument.

***Good uses*:**

- To provide a conceptual map (a navigation aid through ideas, arguments or processes)
- To emphasise key points
- To illustrate (i.e. show pictures of things described in the text)
- To provide an alternative representation (i.e. alternative to text, tables, etc.)
- To summarise
- To contrast two things
- To clarify.

***Bad uses*:**

- As part of a sinful attempt, usually futile, to cover up for bad writing
- As comic relief (usually inadvisable).

Final chapter(s)

Your goals here reflect those in the introduction: you use the final chapter(s) to show the reader that you have achieved something worthwhile over the last few years and to create a good closing impression. Typical ingredients of the final chapter are:

- Summary of results (may be compared explicitly against objectives stated in the introduction)
- Discussion about how the results generalise
- Discussion of limitations (phrased positively)
- Statement of contribution to knowledge
- Future work (phrased strongly and positively)
- Speculation (in moderation).

Appendices

What goes into appendices? Answer: material that needs to be available to the reader, but doesn't need to be in the main text, such as:

- Data
- Detailed statistical analyses
- Instruments (e.g. questionnaires)
- Examples
- Code (if the PhD involved writing software)
- Glossary of terms.

Remember: examiners read appendices. Kind examiners read them to find reasons to spare you; unkind examiners read them to find evidence of sin.

Academic style: an example

A point worth noting is that good academic style is *not* the same as formal grammar – there are plenty of cases of students who write in good academic style, even though they are not native speakers of English and their formal grammar is wobbly in places. Conversely, there are many native speakers of English whose understanding of academic writing is woeful.

So, what do we mean by 'good academic English' and why is it not the same as formal English grammar? The example below is lightly adapted for brevity from a paper by one of us and a colleague. It has been chosen specifically because its topic will be unfamiliar to most readers, making it easier to demonstrate how language is being used at both the explicit and the 'between the lines' levels, and reflecting both instrumental and expressive behaviours.

> Direct evidence for hemispheric asymmetry in human and proto-hominid brains is in principle obtainable via endocranial fossil remains (e.g. Ponce de León et al., 2016). Unfortunately, the number of suitable skulls is limited, particularly for older species. Much the same problem applies to attempts to infer handedness from the weight and size of hand bones, on the principle that a more extensively used hand will be more robust (and therefore have larger bones) than the non-preferred one (Roy, Ruff and Plato, 1994). There is evidence of such asymmetry in the long bones of the upper limb and shoulder girdle of Neanderthal specimens (Trinkhaus, Churchill and Ruff, 1994; Vandermeersch and Trinkhaus, 1995) but the paucity of suitable pre-Neanderthal material limits the scope for this approach.

There are several types of coded language in use here that signal engagement in the appropriate research discourse. These include the following.

Technical terms

Technical terms are precise and signal membership of the relevant research community: 'hemispheric asymmetry, protohominid, endocranial, robust, non-preferred, long bones, upper limb, shoulder girdle'. 'Robust' is a technical term, the converse of 'gracile'. 'Long bones' is also a technical term, contrasting with 'short bones'. The first use of a technical term should be accompanied by a reference.

References

References signal familiarity with relevant literature: (Ponce de León et al., 2016); (Roy et al., 1994); (Trinkhaus et al., 1994); (Vandermeersch and Trinkhaus, 1995). All are specialist journal articles. The first article is recent, which implicitly makes the point that the older references in the same paragraph are still the key references for the point being made, since the authors of the paragraph are clearly familiar with the recent literature. Reference to existing published research demonstrates that your research argument builds on this existing discourse.

General academic language

General academic language signals membership of the general academic community: 'in principle, via, much the same, infer, there is evidence of such, paucity'. Note how specific claims about inferring handedness via specific methods are supported by references, while a broad statement about lack of suitable fossil material is not supported by a reference. Within this research community, the lack of suitable fossil materials is a generally agreed truth which does not require a supporting reference; the authors have already demonstrated their membership of this research community via their familiarity with its literature and technical terms, so can make the broad statement without a supporting reference. Writing for a different research community, a supporting statement might well be needed (for instance, if the different research community had not reached a consensus about the lack of suitable fossil remains, or was completely unaware of the issue).

Note also how an entire approach is described and rejected in two sentences. The authors throughout assume that their readers will be familiar with a range of technical terms relating to physiology, such as 'endocranial' – this assumption is made because the paper is for publication in a journal catering for a well-defined research community (laterality researchers). This assumption reduces the need to unpack and explain terms; this in turn means that the writing can be terse and efficient. If the authors deal with terms unlikely to be known to the readers, then it is necessary to explain each term on the first occasion when it is used (as happens later in this paper when the authors describe flint artefact manufacture).

Academic style: sending signals

Everything you write sends out some sort of signal between the lines, either through what is there, or what is not there. What you write conveys the argument and supporting evidence that are instrumental to your thesis – and also (ideally) expresses your competence as a researcher.

***Good signals to send include*:**

- I'm a professional with the right attitude and a good understanding of my subject
- I know what I'm doing.

***Bad signals to send include*:**

- I am ignorant, clueless and in despair
- I am lazy, dishonest and rude, and I deserve to be hanged and flogged.

How do you communicate these things? They vary in effort.

I'm a professional with the right attitude (easy concepts, but hard work)

- I pay attention to detail in things like spelling and the layout of the references
- I've done meticulous work and demonstrated this in the write-up
- I've presented this work neatly and exhaustively, following the conventions of this area.

I know what I'm doing (requires knowledge of your chosen field and hard work)

- I know all the key texts, have read them and have cited them correctly
- I have read other relevant things as well and have cited them correctly
- I know and understand the technical concepts in this area and have been careful to use all the relevant ones somewhere in my write-up.

I am ignorant, clueless and in despair (all too easy to communicate, especially in the second year of a PhD)

- I have not read the key texts
- I have made classic mistakes without even realising it, and have not had the wit to show my draft to a reliable mentor who would have spotted them ages ago
- My work contains apologies and pleas for mercy.

I am lazy, dishonest and rude, and I deserve to be hanged and flogged (effortless, if you're a sinner)

- My work contains hardly any references
- My references are all from the Internet, popular magazines or textbooks
- My spelling, grammar and presentation are dreadful
- I have attempted to conceal the dreadfulness of my spelling, grammar and presentation with jokes, clip art, a fancy binder, coloured pie charts and a grovelling acknowledgement to my supervisor
- I have misspelled my supervisor's name and got their title wrong in the grovelling acknowledgement to them
- There is no evidence in what I have written that I have done any work
- Some paragraphs of my text are much better written than others, and bear a strong resemblance to articles on the Internet
- I have done things which my supervisor specifically told me not to do
- My text compares theory and academia unfavourably with the 'real world' but I have not put my money where my mouth is and gone away into the 'real world'.

If these things apply to you, then you will probably not even be allowed to start a PhD – the initial selection process will almost certainly detect you and hurl you into the outer darkness. If you sneak through the initial selection, then the probation or transfer process will do so. It is unlikely that anyone fitting this description will be conscientious enough to bother reading this book anyway; we have included this section largely as a reassurance to virtuous but insecure students, so that they know they aren't as bad as they sometimes fear.

One useful tip is to go through your text with a highlighter, highlighting any words or phrases which would not be familiar to the average person on the street. This is particularly useful for your first page, and especially for the first paragraph, where first impressions count. If there's hardly any highlighter on the page, it might suggest a lack of engagement with the academic literature – or worse, a lack of academic content. On the other hand, if there's hardly anything *not* highlighted, it might suggest an indiscriminate jargon binge (and a very tedious read). Balance matters: judicious use of technical language shows authority and provides explicit connection to the academic literature; setting that usage within a readable narrative demonstrates clarity of thought and communication. So, consider each bit of highlighting: is this instrumental (e.g. purposeful use of technical precision) or is it obfuscation (i.e. using impressive words just to show off or, worse, to mask an underlying weakness)?

A tip so obvious that it's easy to forget: get your spelling and punctuation right. If necessary, check the settings on your word processing software, buy a dictionary and/or go on a training course. If you're claiming to be a highly educated professional and you can't spell and use punctuation correctly, then you're off to a bad start. (Reassuring note to readers with dyslexia and similar conditions: Whatever its faults, The System is now much better about supporting people. There are mechanisms, such as using a copyeditor, that are acceptable within The System to help you achieve your goal.)

The phrasing and style you use can send out both intended and unintended signals; Table 10.1 gives some examples. Although it's couched humorously, the underlying points are serious – learning to send out the right signals between the lines is an important skill.

Avoiding the wrong signals

Different styles of writing are used in different fields – because you are serving different purposes, communicating with different audiences, and expressing different identities. In commercial writing, for instance, the purpose is frequently to persuade the reader. This is very different from informing the reader. For instance, an advertisement will typically focus on the strong points of a product, with little or no information about its weak points or about the strong points of competitors. In most of academia, this sort of blatant sales pitch is viewed as somewhere between tacky and downright unethical. To take an extreme example, if you only describe the successes of your new cure for cancer, and don't mention that it has a 90 per cent fatality rate among the other patients, then

you're doing something criminally unethical. So, the convention in academia is that you give a full account of what you found, with as little emotion as possible. Use of persuasive or emotional language in academic writing will usually send out the signal that at best you're clueless, and at worst you're trying to mislead the reader.

You are trying, through your use of language, and the clarity and precision of your arguments, to achieve an appropriate academic 'voice', the writing style that conveys your attitude, personality and character. The details of preferred writing style vary across disciplines, but the principles remain the same. One key principle is to use the right 'voice' to send out the right signals to readers, including examiners, which is the subject of the next section, and to avoid sending the wrong signals, which is addressed subsequently.

Making examiners happy

You want to end up with the examiners looking pleased and relieved as they finish reading your thesis and settle down for whatever examiners do in the evening. You do not want to end up with the examiners being worried or angry.

Start by looking at things from the examiners' point of view, particularly the external examiner's. If you're eminent enough to be an external examiner, you'll be chronically overloaded with work, and be torn between a desire to see standards maintained and a desire to get the whole business over with as soon as possible. You will hope to see a thesis which is a clear, unequivocal pass. You do not want to see something which might just about scrape through with major revisions: this will entail weeks of further hassle for you when you wade through those revisions. So, what makes an external decide that something is a clear pass rather than a thing of horror?

The basic issue is whether the thesis is an original contribution to knowledge at an appropriate level for a doctorate. If the relevant boxes can be ticked unhesitatingly, then everyone is happy and can get on with their lives. You can tackle the first couple of boxes ('original' and 'contribution to knowledge') by some judicious phrasing. If your topic sentences say things such as 'this extends the classic work in this area by Smith and Jones (2002) by applying rough set theory', then the 'originality' bit is pretty clear: your original contribution is the extension of Smith and Jones' work. If you use phrasing such as 'these findings have significant implications for research in this field, which has typically viewed this topic as of comparatively minor importance', then the 'contribution to knowledge' bit is also pretty clear – if you're not exaggerating. Judicious phrasing by itself is not enough; you need to have done solid research as well. However, good research needs to be presented clearly or there is the risk that the examiners will miss the needle of your original contribution in the haystack of your rambling prose.

The third box ('appropriate level for a doctorate') is not so easy to locate precisely in the text; like the lettering in a stick of rock, it runs all the way through. The examiners will be reading between the lines of your thesis, and if you have written the right things between the lines then everyone will be happy. Most of this will consist of numerous small things, minor by themselves, but

major when taken together. For instance, if you've been developing a taxonomy of social inclusion problems in secondary education, then showing that you have read some of the literature on taxonomic theory is likely to send out the right signals to the examiners, but will not by itself be enough to demonstrate doctoral-level research – you'll also need to use the right language and technical terms throughout, to refer to the right literature, to discuss the findings critically at the right level of abstraction, and so forth. Practising academic writing throughout your studies will help you do this automatically when you write up, and significantly improve your chances of a strong outcome.

Blood in the water

Swimming in shark-infested waters is a bad idea if there is blood in the water. An examiner will readily detect blood in the water – for example, if the theoretical foundation for your argument is weak, if your data sample is compromised, if your conclusions exceed your evidence.

Don't go into predator territory if you have open wounds. If your work isn't good enough, then don't present it; go back and get it right, instead of presenting inadequate work and making apologies for it. Make sure that you show strength and professionalism. Here is a good example (from a seminar by a colleague): 'We found the following results . . . however, feedback from the subjects afterwards indicated that our initial instructions had been ambiguous. When we replicated the initial experiment with revised instructions and a new set of subjects, the results were as follows . . .'

The subtext here is: 'I take it utterly for granted that you redo an experiment without hesitation if you have to, regardless of the time and trouble – trying to plead for mercy and present inadequate data isn't even on the agenda for me.' The key aspect of the presentation here is that the second sentence follows immediately from the first one, without hesitation, and plunges straight into the results without making a big thing out of the fact that the researchers took the trouble to redo the experiment. Somebody who treats this level of professionalism as taken for granted will probably have been meticulous about everything else in their study too, so the predators know there's not much point in trying their luck.

Avoid vagueness and evasive language

Vagueness is not acceptable. From an actual examiner's report:

> In an academic argument the details should all be nailed down, as far as this is possible. Often it is best to omit things of which one is unsure. If this is possible they should not be present anyway. If it is not possible, they must be established definitively. Otherwise the conclusion will inherit the lack of precision. Then the whole work may simply become a piece of unproven speculation, which is unacceptable for a doctoral thesis.

Vagueness and evasive language are classic signs of weakness and doubt. Some words and phrases which indicate weakness are 'weasel words', whose

purpose is to help you wriggle out of committing yourself to an assertion and substantiating it. Words such as 'possibly', 'presumably' and 'must have' are another way of saying, 'I have no firm evidence for this, and am guessing.' If you have evidence, present it; if you don't have evidence, and the issue is important, then get evidence and find out whether you are actually right in your guess. Weasel words usually have no place in academic writing, and certainly not in a dissertation. It is not normally good enough to say that something 'seems' to be something else: is it or is it not? Weasel words suggest that the author has not looked hard enough or is making speculations which cannot be substantiated.

They're very different from reasonable caution. For example, when you're showing reasonable caution, you might use the word 'probably' as opposed to 'possibly' when describing one potential explanation; the key point is that you could show why the evidence makes this explanation more likely than not to be correct. 'Possibly' in this context could cover anything from a reasonable but unlikely explanation to wild speculation, and would need some careful context to reassure the reader that you're not just guessing.

Speculation is something which should either be explicitly labelled as speculation (and therefore of only tangential relevance) or saved for the closing stages of the discussion section where you are discussing future work, or preferably both.

Don't rely on 'what everyone knows'

Watch out for the temptation to use public-domain principles as explanations. 'What everyone knows' is often wrong or seriously misleading. This is one case where the Internet is positively useful – the sci.skeptic and alt.folklore.urban newsgroups are rich sources of widespread beliefs which have no basis in truth. Make sure you have a proper academic source for any explanatory principles you want to use. If you can't find one, then it might be because the principle just isn't true . . .

Don't bluff

If you don't understand something, make time and work on it until you understand it. If you try to use technical concepts without understanding them properly, the critical reader will spot it instantly.

One apparent exception to this is when you are using advice about specialist tests (generally in the context of choice of statistical test). The normal convention in many disciplines is that in such cases, where the expertise is outside what a researcher in the domain could be fairly expected to know in detail, it is acceptable to take advice from two or more independent authorities in the relevant area and follow that advice. If they get it wrong, then that isn't your problem, because you've taken reasonable steps. You'll still need to understand what the statistical results mean, though.

Some classic style mistakes, and how to avoid them

- Don't waffle. It's your responsibility to be clear, not the examiners' responsibility to divine your meaning

- Don't try to evade an issue by vague or ambiguous wording – examiners are very good at spotting this and will grill you mercilessly about it in the viva
- Don't over-simplify. Write for fellow professionals or you'll come across as not understanding the full complexities of your area
- Don't use big words if you aren't absolutely sure of your meaning. A big word, wrongly used, will make you look like an idiot
- Don't use jargon unless it's necessary and appropriate. Clear, straightforward writing conveys authority better than 'buzzword bingo'
- Don't follow the conventions of another discipline or country in the style of your write-up. If you don't know the conventions of your discipline, find them out. If you disagree with them, then do so *after* you've got your PhD
- Finally, and most importantly, don't forget the three golden principles: don't lie; don't try to be funny; but above all, don't panic and blurt out the truth.

Dissertation FAQs

***Q*:** Do I need to include everything I've done?
***A*:** No. If a subset of data, or an entire study, is not essential to the thesis, you don't need to include it. Note, however, that this does not apply to the situation where one study shows that your initial hunch was clearly wrong: in this case you must include the study. If you do research sensibly, then you will be phrasing your questions as a series of reductions of the problem space, rather than a search for confirmatory evidence, so this issue should not arise.

***Q*:** Do I need to include the raw data?
***A*:** That depends on the conventions of your discipline; check with your supervisor and your institutional regulations. The usual principle is that appendices should include examples of what you used at each stage, starting with instructions to respondents, continuing with examples of data collection instruments that you used, and also showing one or two examples of completed response sheets or whatever it was that you used. This allows the examiners to check what you did at each step, and to satisfy themselves that you did it right.

***Q*:** How long does the thesis have to be?
***A*:** As long as it needs to be to do its job, and no longer. The full significance of this answer won't make much sense to you until you've supervised undergraduate projects and taught research methods yourself; in the short term, check the regulations and ask your supervisor. The lesser answer is: within the maximum page or word limit set by your institution.

***Q*:** I've just discovered a mistake in my analysis of the data, two days before I'm due to hand in. What do I do?
***A*:** Good question. Whatever you do, *don't lie.* Get in touch with your supervisor immediately and ask for advice about how to handle the corrections. If

it's a major mistake, you'll need to redo the analysis, for all sorts of practical and ethical reasons. If the mistake is comparatively trivial and you're about to run out of time, your supervisor may be able to suggest ways of buying time within The System so that the deadline is not an issue. If the mistake only applies to a manageably small subset of the write-up, another possibility might be a rewrite which simply cuts out that part of the analysis.

***Q*:** I'm writing up, and I've just discovered that someone else has published something almost identical. What do I do?

***A*:** Don't panic. It's usually possible to present the same material from at least two different viewpoints. Talk to your supervisor about this. You should be able to rephrase your work to describe the other person's work, and to differentiate yourself clearly from it. You might be able to compare and contrast your results and theirs.

***Q*:** I've developed writer's block. What can I do?

***A*:** The standard-issue books have plenty of ideas, and there are some in Chapter 12. Examples include deliberately doing something completely unrelated to writing up; writing something deliberately inaccurate, so that your subconscious rebels and makes you start writing the truth; rewarding yourself with treats; setting yourself small, manageable goals; and getting a friend to help motivate you.

***Q*:** Can I write up in the same style that you use in this book?

***A*:** You must be joking. This is the style we use over a cup of coffee; the style we use in our academic articles is very, very different.

Academic style: summary

What you need to remember is to get your cabinet-making skills visibly onto the pages. Your references are an obvious example. Do you have the key references in your bibliography? Do you have the right spread of dates? Do you have references showing independent reading outside the standard stuff? Do you have references showing that you're a nit-picking perfectionist who has done thorough background reading? And so forth. Another obvious example is the types of study you've conducted. If you're working in a discipline where cabinet-making includes doing big surveys with heavy stats, and in-depth case studies without stats, then you need to make sure that your studies are clearly (but subtly) presented in a way which fits neatly into that framework. At this point, style intertwines with content and structure; we'll now move on to other issues involved in writing, in the next chapter.

Table 10.1 Reading between the lines: some classic examples

You say	Others read this as meaning
e.g. Green and Brown 1998; Smith and Wesson 1999; Jekyll and Hyde 1999; Young, Gifted and Black 1999	I've found lots of stuff with relevant keywords, but I can't distinguish among the papers
Smith says	I haven't read many journal articles
explains Dr Smith	I read too many magazines
enthuses Dr John Smith	I read too much trashy fiction
there is general consensus that (a)	there is some agreement that
there is general consensus that (b)	I don't have any specific references but this sounds like a plausible claim
it is clear that	I think
it is arguable that	I hope
a larger sample might prove	I don't understand anything about inferential statistics or survey methods
a recent study found that	I don't have a reference for this, but I'm fairly sure it's true
there is some anecdotal evidence that exciting	some people told me in a bar that I haven't grasped the point of academic writing yet
achieve it's potential	I want to look as if I've wasted years of education
excede it's potential. A serendipitous instance of such hegemony is	Here's where I start plagiarising stuff from real researchers who can use big words correctly
objective	I don't understand research methods properly
bias free	I don't understand research methods properly
I think	I am clueless, and also haven't heard about the third person passive
(though cf. Green *et al.* (in press) for an interesting re-evaluation of this literature)	I've read the advance literature, so sod off
Smith (in press)	I'm on such good terms with Nobel Prize winners like Smith that they send me preprints of their papers

(continued)

Table 10.1 (continued)

You say	Others read this as meaning
Smith *(pers. comm.)*	Smith mentioned this when we met in the toilets at Schiphol Airport on our way to the conference last year
a strong similarity to the debate in the 1950s over X	I'm thoroughly familiar with the literature back to before most people in this area were born, so sod off
per se	I had a proper classical education, and can use sophisticated Latin terms correctly, so . . .

Chapter 11

The process of writing

• Removing distractions • Getting started on writing • Surprising yourself • Finding a focus • Keeping going • Obstacles • Allow time for reflection, review and housekeeping

Most people have strong feelings about writing, and especially about writing the dissertation. These feelings often include dread, confusion, despair and being utterly sick of the whole topic. If you are in this state, then be reassured: these feelings are completely normal and are fixable.

If you have ended up in this state, the first thing to remember is that so has pretty much everyone else. Successful researchers and writers are not ones who've never encountered these problems; they've encountered the problems, and come through. So can you. This chapter is about the process of writing, with particular reference to common problems, but also with reference to things that will help your writing process when things are going well.

If you're reading this chapter because you're feeling bleak and low, then just remember the bottom line about the thesis: it doesn't have to be amazing; it just needs to show you have the skills needed for a PhD.

One key concept introduced earlier is working backward: knowing where you want to end up with your writing – for instance, knowing which question you want to answer at the end. Another key concept is structure: the chain of reasoning and evidence in what you're writing. If you've got these under control, then you shouldn't feel very lost. However, students are human, so there will be times when you feel dispirited and unable to face starting writing. There will also be times when you have trouble mentally organising the mass of detail that you have to deal with. The rest of this chapter contains lists and tips which you may find useful if you're in this situation.

Removing distractions

Think about where you're writing. Are you in a setting conducive to a 'down to work' mentality? If there are people around you, are you distracted by their conversations? If the setting is distracting, move to the library, or a quiet café – somewhere that allows you to focus.

Park your gadgets: Switch off message and social media alerts on your computer, phone, or any other electronic gadgets. Put your mobile phone in a drawer. Strip down to the technology necessary to your task.

The shoebox: Put your out-takes and extra ideas in a safe place, such as a shoebox or a 'good ideas' Word file, for later use. Then stop thinking about them while you write your dissertation.

Don't edit until you have a complete first draft: It's easier to edit a complete rough draft into something reasonable than to edit first and complete later. If you focus too much on the first paragraph, you'll probably never reach the final paragraph.

Sharpen your pencils: Writers often develop rituals to help them get into the mindset. Put a strict time limit and structure on the ritual, lest it become a distraction in itself. So, for example, sharpen three pencils and clear the desk – then begin.

Getting started on writing

Talk to a friend: Tell an intelligent friend the story of what you're trying to write. Tape what you say, including how you answer your friend's questions. If you don't have a friend handy, imagine one, and talk to the recorder.

Write it 'wrong': Many problems involve getting started. Writing something that's definitely wrong will give you something to correct – which is often easier than starting from scratch.

Question–answer: Either with a friend, or talking to yourself, conduct a question–answer sequence, starting with 'What's the message?', with each question following on from a previous answer and 'why' and 'how' featuring regularly.

Amanuensis: Get someone else to play 'amanuensis' (a literary assistant) and to write a short narrative based on what you say. Your amenuensis may do a good job, or may write something inaccurate; either way, you'll have something to respond to.

Throw away the first half hour: Promise yourself that you'll throw away whatever you write in the first half hour. That means that you can write garbage, a letter to your mother or a version of what you intend – anything, as long as it's prose. The idea is just to start composing sentences and paragraphs, without regard to quality. (If it's good, you can always keep it, but if it's bad, you promised yourself.)

Just start typing: Sometimes it helps to start up the cognitive 'subsystems' separately – for example, to start typing anything just to get seated in the right position with fingers moving, then typing canned text just to get a flow of words from mind to hand, and only then to start composing.

Don't start at the beginning: Skip the introduction and start with the material which is most familiar, or easiest to express. Alternatively, start with the most challenging part.

Extreme writing: Set a target, and then sit with a friend and write collaboratively, intensively, for a fixed period. Short periods – even just five minutes – can be surprisingly effective.

Surprising yourself

Change mode: Sometimes just changing the visual appearance of your text (e.g. type font, formatting), or the kind of writing (e.g. from academic paper to children's book), or the mode (e.g. visual instead of verbal), or the medium (e.g. paper instead of computer) can make the material look 'fresh' or expose something different.

Write the Ladybird version: Ladybird is a publisher of children's books, including early-reader non-fiction. Distil the most fundamental story and write it in very simple language. This is also very useful practice for producing simplified versions for outreach to schools, etc.

Storyboard, with pictures: Follow film-making practice and sketch out a 'storyboard' of the narrative, with a frame for each of the key statements, using pictures instead of words. You can even talk through the narrative, acting out the frames. Unusual, but potentially inspiring.

Finding a focus

Find the red thread: Remind yourself what your Big Picture is before you dive down into detail. The dissertation must have a clear plot or 'narrative spine' (see Chapter 10). The narrative should be a connected sequence of elements, each leading to the next, and all leading to the conclusions. An evident red thread means that the thesis is clearly delineated, and provides clarity about what's important and what's peripheral. Another way to think about it is

that all the elements of your dissertation must ultimately contribute to the Big Picture; any work that doesn't contribute to it should be left out. If you continually reassess the Big Picture and the red thread that runs through your dissertation, then you'll be in a good position to make a coherent account of your work.

Find a model: Find a paper or chapter that does the sort of thing you're trying to achieve (e.g. presenting a study). Analyse what makes it exemplary for you: what it contains, how it's organised, what gives it its character. Create a template from it, then start filling it in with your own material.

Work backward: As discussed in Chapter 10, start by thinking where you want to end up: imagine the finished paper, or the finished chapter (you might use a model to help you, see above). Then work backward from the product, identifying major components, sorting out critical paths to those components, and so on, until you find a place to start.

Headings: Write the headings before trying to write the text. This allows you to fix the overall 'story' or structure in your mind and to work through the sequencing of presentation before you get bogged down in details.

What's it for? For each section (or paragraph), write a comment on its *role* in the document (e.g. *this is where I introduce my thesis*; *this is where I outline the major competing theories*; *this is where I give a precedent for the method I've used*).

Keeping going

Incentives: Give yourself mini-incentives (e.g. line up treats somewhere nearby and allow yourself one after each section that you draft; give yourself a play day after a solid week's writing).

Progress table: Set out your section headings in a table and fill in the word count and time as you complete each one. Total the word count at the end of the day.

Obstacles

Writing is not a single activity. It is not just 'writing down', not just a simple transcription from mind to page. Rather, it is many activities: analysing, elaborating, remembering, synthesising, mapping, ordering, articulating, clarifying, editing, criticising, structuring, sense-making – as well as transcribing. With so many cognitive activities interacting, of course it's complex and demanding. Having the right expectations about it helps to make it less daunting. Having supporting habits and infrastructure helps to make it manageable.

Perspectives on writing

- Writing is difficult, and it takes time. Do the calculation: how many useful sentences can you write in five minutes? How long does it take you to write a page? You can then plan your writing schedule more realistically
- Writing is about making the underlying story clear
- Academic writing is about completeness and honesty of content, as well as about making sense
- Dodgy material (sloppy thinking, poor mapping to theory, dodgy results) makes writing difficult
- Trouble with writing may indicate problem areas in your research rather than problems in your attitude – if you encounter trouble with writing, then look closely at what you're trying to do.

For many people, writing is scary. Educators talk about 'fear of failure' (anxiety about the consequences of making a mistake or not being good enough becomes an obstacle) and 'fear of success' (anxiety about the increased expectations associated with success becomes an obstacle). It's important to recognise and face your fears. Yes, it's scary. But it's not impossible. The key realisation is that *getting something written is better than not getting anything written.*

Once you've written something, you've reduced the problem. Writing can be approached as a series of stages: dumping ideas, prioritising ideas, putting ideas in order, elaborating an initial structure, turning notes into text, editing for structure, editing for language, checking for redundancy, editing for 'voice', and so on. One of the most important aspects to isolate is 'dumping ideas'. Once you've got something on paper, you can turn 'writing' into 'editing' for a while. A good tip to remember is: no editing until everything is written once.

Another discipline is Keep It Simple – a principle that applies to most design activities. The simplest language that does the job – the simplest vocabulary, sentence structure and rhetorical structure – is often the best. Keeping it simple is different from 'schematic writing'. Schematic writing (e.g. bullet points or a simplified summary) achieves simplicity by leaving out a lot of detail. Simple academic language keeps the detail, but explains complex concepts and data with simple words and structures.

General advice

- Writing is a skill, and like most skills it improves and becomes easier with practice
- Make a commitment to write something every day and to produce a finished piece of writing – a couple of pages – every week. Try to present material in writing at every supervision session
- Organise the ideas/concepts/material before you start to write
- When someone critiques your writing, think about it from their viewpoint, rather than going onto the defensive: why did the critic make those comments or suggest those changes?

- If someone copy-edits or redrafts your writing, take the time to analyse the changes: why those changes, what do they change and how do they improve the prose? What can you learn from that?
- Be precise.

Writing obstacles raised by students

Problem: *starting to write anything; not starting to write because the subject is not 'good enough'*

Try just 'dumping ideas' as a first step. Remember: any writing is better than no writing. Don't worry about whether it's 'good enough'. It probably won't be until you finish writing it – writing it is part of the process of making it 'good enough'. (There's a research literature on this subject . . .) If you have trouble writing something, it probably means you haven't got it clear in your mind yet.

To get it clear in your mind, you can try methods such as:

- Tell it to a friend over coffee (and then maybe have the friend tell it back to you)
- Play 'Eliza'. Eliza was a computer program that simulated a therapeutic dialogue. Actually, the program only had a limited number of conversational gambits, none of which added any new information, but those few could be, to coin a phrase, effectively elicitative. So to play the Eliza game, you simply start with an initial remark and then build on that through some simple-minded questioning. For example: 'I want to write about purple elephants.' 'Why?' 'Because purple elephants are more interesting than grey ones.' 'What makes them more interesting?' 'Because most elephants are grey, and purple ones are unusual.' 'Are all purple ones unusual?' Every so often you can throw in a *non sequitur* (although it doesn't have to be 'What do purple elephants have to do with your mother?' – the type of *non sequitur* Eliza might use). What you're doing is asking yourself repeatedly: what do I think, why do I think it and why should anyone else care?

Problem: *structuring the narrative*
For example:

- I know the main points but I don't know how to present them
- I can't progress from the draft to writing the final version
- I can't explain it clearly
- I can't find a clear structure.

Good writing is typically a process of drafting and redrafting. So don't expect to get from ideas to polished prose in one step. Going from ideas to *notes* is usually reasonably easy. So what's the difference between notes and prose? Usually: structure, order and complete sentences. The key is finding the right structure – first the structure of the ideas and then the linear structure of the argument or story you want to make about the ideas.

Try some of the methods below for structuring ideas:

Mind maps: Once you've got all the ideas mapped out, then you can try to arrange them into a linear order.

Put ideas on index cards – one to a card – and then arrange them in different structures. Again, you can do this in a series of passes, using a different criterion each time; this will help you to identify core concepts, structures and outliers.

Outlining: experienced writers often advise writing a very detailed outline as a first step. Different sorts of outlines can help: for example, a detailed table of contents, versus a table of contents with a paragraph of text in each main section, versus a diagram showing each section as a box, with sub-sections as smaller boxes inside.

Problem: *using too many words to write something that my supervisor does laconically*

Solving this is a matter of practice, both of writing and of editing. Keeping it simple helps. But also understand that simplicity is not just a matter of word count – sometimes a few more words can make the writing simpler and more accessible. Work at the structure of the argument, and review your draft for structure (the 'highlighter test' might help).

Before you hand a draft to your supervisor, do an editing 'pass', looking specifically for redundancy or wordiness. When your supervisor revises it, analyse the changes: what was expendable and why?

Problem: *needing to develop an academic writing style*

Collect papers that have a good writing style and an appropriate voice. Analyse them: what do the examples have in common? What makes them appeal to you? How do they handle tough aspects of writing? How do they highlight and present key ideas? How do they introduce vocabulary? When you're writing, consider how one of those authors might have structured or phrased your material. See if there's an analogous passage in one of them that you can use as a model.

Problem: *it's easy to grasp my results from a table, but I find it difficult to explain the same thing in words*

Tables and graphs should always be introduced in the text. It's not enough to say 'The results are in Table 2'; Table 2 should be discussed in the narrative, and possibly also in the caption. This doesn't mean describing Table 2 exhaustively, item by item. It means leading the reader through the significance of Table 2 and its role in the argument. What does the table show? How do you intend it to be interpreted? The text should describe the key features of the table that lead you to a particular interpretation. It should relate the information presented in the table to the greater argument. What messages do you mean to convey by presenting the table? The narrative should summarise the table and articulate your messages about the table.

Problem: *deadlines (always missing them)*

Writing is hard, and it takes a long time. Always allow at least twice as much time as you think you might need. Remember that time-on-task is not the same as elapsed time; often a task consists of several short sub-tasks, separated by intervals where you're waiting for someone else, or whatever, meaning that the time from start to finish of the task is much longer than the time you've spent actually working on it. Deadlines don't go away. As your career progresses, there will be more deadlines and more responsibilities competing for your time. (Go review the section on Project Management, p. 55.)

Allow time for reflection, review and housekeeping

You should have already written up a fair amount by the time you reach the end of the active research in your PhD. Some parts, like the references, you should have been conscientiously building up as you went along. Others, like the 'method' section if you're doing an experimental PhD, can be written up as you do each study, and are unlikely to change significantly.

What will change most are your introductory and discussion sections for each chapter (including your initial chapter and the main literature review). By the end of the PhD you will almost certainly have realised that the real issues in your topic are different from what you thought at the start, so the literature review you write in year three will be very different from the literature review that you wrote in year one – even if it cites the same literature. This is completely normal and healthy; it would be worrying if you studied a topic for several years and concluded that your initial hunches were as accurate a set of insights as those obtained by several years of study.

So, what is the implication for you? The implication is that you will, if you have any sense, seriously consider writing your introductory and discussion sections again, from scratch, at this stage. This will allow you to make sure that your narrative spine is good, with each section leading neatly into the next, rather than looking like a collection of random items strung together more in hope than expectation. You can, for instance, pose a neat set of questions in the introduction, make sure that each set of tables in the results relates clearly to one of these questions, and then discuss the answers to the questions one by one in your discussion section, with all the potential loose ends neatly tied off.

Using the cabinet-making analogy again, you need to polish the final work. Make sure that the first pages the examiners read are all pages which display your skills – good references, evidence of expertise, good presentation, etc. Allow plenty of time for this. Fixing minor punctuation errors in your references is not conceptually taxing, but it takes a lot of time if you have made a lot of minor errors. Then, with any luck, you should have a thing of beauty.

Chapter 12

Writing for publication

- *Different forms of writing • Journal papers as an example*
- *The submission and review process • Authorship agreements*

Although the dissertation is the focal piece of the PhD (the 'master piece'), other forms of writing may feature both during and after the PhD process. As indicated in the previous chapters, different forms of writing have different purposes and different audiences, and require different 'voices' or styles. There are also commonalities among the different forms; for example, the basic process, the need to for the particular audience, the need for a 'red thread', the need to understand the roles of theory and evidence in making your argument. So it's worth trying different forms and reflecting across them.

Different forms of writing

If you intend to continue as an academic after your PhD, you will also need to publish in the appropriate academic venues for your discipline (usually journals and conferences). Journals, conferences and magazines, all have strict conventions about structure, format, style and content – and these may vary not just with the type of publication, but also with the venue. If you ignore the conventions, then you probably won't get published.

You will also need to write funding proposals, which also have strict conventions which may vary from funder to funder. Although this is an important topic, it goes beyond the scope of this book; we'll simply observe that some time spent picking the brains of skilled writers of funding proposals and reading successful proposals will be time well spent.

You may also, depending on your career path, need to write some or all of the following: press releases, blog posts, articles for trade magazines in your discipline, promotional material for your department and/or website, policy documents, technical reports, technical manuals, consultancy reports and patent applications. These, as you might guess, all have their own conventions, and their own ways of reading and writing between the lines, and these can vary considerably between disciplines.

In this book, we focus on writing the PhD dissertation and journal articles, which are the two most important topics for most PhD students. Once you've grasped the concepts behind these, you should be able to learn the rules for other types of writing fairly swiftly – the key points to remember are that there are different rules for different types of writing, and that if you can find out the reasons for those rules, then you'll probably find it much easier to write well in those styles.

Journal papers as an example

This chapter focuses on journal papers in order to cover the core issues: the process, what matters, and why. This is a guide for beginners. Notionally, journal papers are written to the same high academic standards as a dissertation; hence publishing a paper in a reputable journal is usually viewed as a sign that you are a fully-fledged academic. Similar basic principles apply to conference papers, book chapters, etc.

Writing a journal paper can be a good thing (e.g. providing experience and feedback) or a bad thing (e.g. if it is used as a displacement activity from something more important). So consult your supervisors before you start, and act on their advice.

The status of publication with respect to the PhD varies depending on the degree and university. Publication can contribute to your thinking and confidence. 'PhDs by published work' require a collection of publications, usually journal articles, brought together into a thesis and united by an overall narrative – but in many universities, for conventional doctorates requiring a dissertation in the form of a monograph, a journal paper is neither necessary nor sufficient for a PhD.

The submission and review process

The review process, which is fairly standard, goes something like this:

1 **Planning:** You choose a journal, read its guidelines for contributors (which will tell you the review criteria, word limits for articles, the procedures for handling tables and figures, the number of copies to submit, etc.), and look at recently published papers to figure out what that journal considers good practice (e.g. use of theory, presentation of data)

2 **Preparing your submission:** You format and possibly revise your paper to conform to the guidelines and what you've induced about the journal's expectations. It is good practice (and sometimes a requirement) to ask your supervisors to approve the submission
3 **Submission:** You submit your manuscript, and anything else required by the guidelines (e.g. cover letter, supporting documents, copyright statement, contact information, reviewer suggestions)
4 **Acknowledgement:** You will normally receive an acknowledgement of submission
5 **Editor's screening:** The editor handling your submission will a look at the manuscript to determine if it conforms to the guidelines (e.g. word limits) and is in scope. If not, the editor will 'desk reject' the submission. If it does meet these basic criteria, the editor will assign reviewers
6 **Review:** The paper will normally be reviewed by multiple reviewers (three is a typical number) notionally selected for their relevant expertise
7 **Decision:** The editor will consider the reviews and make a decision, usually: accept, accept subject to minor revisions, accept subject to major revisions, reject. Revisions are discussed in more detail below
8 **Revisions:** If you are invited to submit revisions, then take them seriously. Note any deadline for re-submission. Try to understand what's behind the comments. If you decline to make a change, it should be for a good reason; explain why. Provide a table that maps reviewer comments clearly to changes made
9 **Re-submission, re-review, decision on revised submission:** (similar to above) The process will iterate. Often the same reviewers will be invited to comment – but not always
10 **Acceptance:** If your paper is accepted, then there will be some paperwork, such as a copyright agreement. At this point, you may add the paper to your CV. Depending on the copyright agreement, you may be allowed to upload the manuscript to your university's online repository (if it has one) or your website. Celebrate. (If the paper is not accepted, consider the reviews, and learn from the experience. Consider identifying a new venue and revising the paper.)
11 **Copy-editing and proofreading:** Some journals still copyedit and format papers for publication (although many have stopped in order to reduce costs). In that case, they will send proofs for your review, usually within a very short period. Check the proofs promptly and thoroughly, and return them promptly. You will probably not be allowed to add material at this stage, just to check the changes made by the copyeditor and/or proofreader
12 **Publication:** The journal will send you a copy of the published paper in some form. Keep an archive copy.

There are of course variations in the process, more or fewer steps, different time frames, open or double-blind reviewing, and so on. The process specific to your venue is probably covered in the guidance for authors.

Where to publish

The first question is venue (i.e. where to publish). This involves consideration of the prestige of the journal, the readership of the journal, the degree of match between your chosen topic and the focus of the journal, and the acceptance rates of the journal. The usual strategy is to go for the most prestigious journal that you have a reasonable chance of being published in, which then raises questions of how to assess your chances. A cup of coffee with someone knowledgeable is a good idea at this point.

Is your research within the journal's scope? Journals have to focus, because of the sheer volume of research being published – even very specialist journals have to reject a high proportion of good papers because of space limitations. (Journal editors work to a page budget each year, which limits how much they can publish.) You therefore need to make sure that your article is relevant to the journal you are submitting to. A good test is whether you cite any papers previously published in the journal. If in doubt, contact the editor (politely) and ask. Journal editors are normally serious players in their research field, unlike commercial editors, so the editor will be the person who makes the decision about how relevant your paper is. If you are skilful and/or lucky, the editor may like the idea behind your paper and may give you some suggestions on how to present it (e.g. which themes to stress and which to play down). This advice is important and should be treated seriously (though remember that following it does not guarantee acceptance).

Look at recently published papers to figure out what that journal considers good practice (e.g. use of theory, presentation of data, number of references).

A note of warning: there is an increasing number of 'scam' or 'predatory' journals that, roughly speaking, are willing to publish just about anything – for a fee.[1] They skip most or all of the peer review and quality assurance processes of academic publishing. They often identify themselves by sending poorly written emails soliciting submissions from researchers who are not in the relevant field. Such journals are also usually easy to identify from a quick search of the journal's website, or a scan of a few previous issues; the poor writing, sloppy editorial structure, and poor or wildly varying quality of the content are obvious. And, of course, you can always ask your supervisors.

Follow the submission guidelines

You need to do some basic homework, which is neglected by a surprising proportion of aspiring researchers. First read the guidelines for contributors to your chosen journal. These are usually printed in the journal, or available on its website. The guidelines will tell you the word limits for articles, the procedures for handling tables and figures, etc. If you fail to follow these guidelines, your submission may be rejected without review.

1 Beall, J. (2012) Predatory publishers are corrupting open access. In the column 'World View', *Nature* **489**, 179. Available at: https://www.nature.com/news/predatory-publishers-are-corrupting-open-access-1.11385

In the following, we describe the guidelines and explain why they matter.

- **Word length:** Word length (including tables and figures) is important because of the page budget. The editor may have to choose between publishing one longish article and squeezing in two short articles, and will certainly be keeping an eye on the page budget.
- **Specified submission:** Most journals ask for electronic submission. Pay attention to the specified file format, regardless of whether you prefer other formats. Most online submission systems are user-hostile, so budget plenty of time for this stage.
- **Specified paper formats:** Use the journal's template for publications. Many journals save costs by having the authors format the text for publication, so your formatting must be clean and accurate. Those that still use copyeditors will not thank you for sloppy formatting that creates work.
- **Redaction:** Some journals use double-blind reviewing; others don't. In double-blind reviewing, the reviewers don't know who you are, and you don't know who the reviewers are. For this purpose, the submission guidelines may ask you to put your name and contact details on a separate sheet from the rest of the article, so they can be kept separate when the article is sent to the reviewers. They may also ask you to redact any information in the submission that might identify you. Note that this may be difficult, depending on the nature of your work, and that many reviewers are able to identify accurately a subset of 'anonymised' authors based on their subject knowledge.
- **Copyright:** Most, but not all, journals will ask you to assign copyright to them. They will also ask you to confirm that you actually own the copyright and have written permission for any material you've used from other sources that is not covered by 'fair usage' (e.g. figures and images).

Handling the reviews

Read the decision with a level head. You need to understand both what was praised and what was criticised; a good trick is to use different colours of highlighter to mark the different statements, so that you pay attention to both. Be prepared; the reviews may contain wonderfully thoughtful and constructive commentary that will improve your paper significantly – or confused, vague, verbose and mutually contradictory requirements that infuriate you. You should aim to have a reasonable proportion of your papers rejected; if they are all accepted, you're probably aiming too low and should go for a more prestigious venue.

Whatever the outcome, be prepared to learn from the reviews. Good reviewers can be enormously helpful in identifying weaknesses in the paper and suggesting ways to strengthen it. Whether the reviewers are conscientious and constructive, or grumpy and opinionated, their comments can help you understand what works and what doesn't about your writing, and about how different readers perceive it – and hence give you insight about how to improve it.

The wise thing to do with corrections is to take the initiative. Draw up a list of the required changes, work through them systematically, and write a covering

letter listing the changes and stating clearly and specifically how you have made them and where. This makes life much easier for the editor, who may well give you the benefit of the doubt and accept the revisions without passing them back to the reviewers. However, you may need to go through another round of slugging it out with the reviewers.

Things to remember about journal articles are:

- Most articles are rejected
- Reviewers are only human, so don't take it personally if they're rude and contradict each other
- Leading researchers are leading researchers because they learn from their experiences
- Even leading researchers had to start somewhere.

Tables and figures

One frequent source of annoyance to all parties is tables and figures, lumped together here because the implications are similar for both. Many printers, for obscure technical reasons, handle tables and figures separately from text, and insert them into the text after it has been sorted out. Others don't. The guidelines to authors will specify what you need to do with tables and figures. For many journals, you have to put each table and figure on a separate page at the end of your manuscript, and indicate in the text where each one should go (usually via a blank line, and then a line saying 'TABLE 1 ABOUT HERE' at the appropriate point in the text). If you include your tables and figures in the text when you have been told not to, then the usual outcomes are either that you are asked to rewrite the article in the right form, or that the printers produce beautiful text, accompanied by figures and tables which look as if they have been dragged through mud, and which stand in hideous contrast to the crisp, professional-looking tables and figures in the other articles of that issue.

Proofs

Proofs are the printer's pre-final version of what your article will look like when it appears in the journal. For technical and logistical reasons, proofs appear at the last moment and are usually sent to authors with instructions to check them for accuracy, and to reply within a specified and extremely short period, normally one to three days. Don't try to change the content of the manuscript at proof stage; you should only correct errors introduced by the printers. Adding a couple of words can have a knock-on effect that extends to later pages and adds considerably to printing costs. Editors have a correction budget as well as a page budget.

Copyright

Most journals ask you to sign a copyright transfer agreement as a condition of publication. Check your university's policy on this, and check with your supervisors.

Some journals are open access: they distribute papers online without cost to the reader. These often have a different publication agreement: an open license with fewer restrictions on use and re-use. They also often have a different business model, requiring a fee from the authors, rather than the readers. Again, check your university's policy, and check with your supervisors.

The publication guidelines will specify that the article has not been submitted for publication elsewhere. If you submit the same article to two or more venues simultaneously and are caught doing so (you probably will be, because the number of reviewers for a given specialism is usually small), then you will be blacklisted from the relevant journals (i.e. banned from publishing in them). There are sound reasons for this – there are legal implications involving copyright if two journals publish the same article. It also wastes the time of the editors and referees, who are usually overworked and who do not like having their time wasted. Submitting different papers describing different aspects of the same topic is usually admissible, but you need to be careful about the degree of similarity.

Many universities now have open access repositories and will expect manuscripts to be uploaded promptly after papers are accepted for publication. Check the publication's copyright policy; some allow this – but some do not, or have an embargo period.

Authorship agreements

It's a good idea to establish some authorship principles with your supervisors and any other potential co-authors (e.g. other members of a funded project) before preparing a manuscript. These guidelines are the ones that we use; you might find them useful as a starting point. Institutions vary about policy in this area, so don't be surprised if the system in your institution is different.

Before starting

- If you or your supervisors think that the work might possibly be publishable, then agree ground rules for publication as early as possible – preferably before you have committed to a particular project. If you can't agree at this stage, then you won't agree later. If it looks too acrimonious, then think about doing a different project, maybe with someone else. This is also particularly important in relation to intellectual property rights if the concept might bring in money.
- Agree the venue – where you will submit the paper.
- Agree what you will do if the paper is rejected. You do not want to have all the team independently submitting revamped versions of the paper to other journals without your name on them. One sensible option is to agree who will take on the lead role if the paper is to be submitted to another journal; that person will normally then become the first author. This can be repeated until success or exhaustion.

Authorship

- Authorship should be agreed at the outset with all parties – normally the student and supervisor(s), with the student as first author. If you can't agree, then you might need to re-think submitting the paper.
- If the work is a compilation of several projects, then the compilation writer should be first author.
- Authors should have made a substantial contribution to the work. A single advisory session (e.g. from another member of staff) will not normally constitute a sufficiently substantial contribution (but should be acknowledged). If you want to take advice from other members of staff about some part of your work, then check first with your supervisor to avoid inadvertently causing bad feeling.

Submission and revisions

- All authors and co-authors should agree to the final version before the paper is submitted.
- Don't submit to more than one journal at a time.
- If the paper is accepted subject to revision, then all authors and co-authors should have a reasonable opportunity to comment on the revised draft before it is submitted (e.g. by being sent a copy, with a request for any comments within two weeks).
- All authors and co-authors should be kept informed of any developments within a reasonable time of their occurrence (e.g. a verdict and reviews).

After publication

- Each author and co-author should receive a copy of the version accepted for publication (and at least one offprint, if they are provided).

In case of disputes

- Seek advice from relevant people in the first instance, before matters become too unpleasant.
- Where possible, keep a written record of agreements at each stage – for instance, agree authorship via email.

Table 12.1 Paper checklist

Content
• Do you have a clear question?
• Have you demonstrated why the question is interesting?
• Have you demonstrated why the question is non-trivial?
• Have you demonstrated why the answer is non-obvious?
• Is your 'red thread' evident; do you have a clear and coherent argument?
Setting your paper in context
• Have you located your work with respect to the existing literature?
• Is it clear what theory informs your work and how your work contributes to theory?
• Have you discussed the assumptions, antecedents and limitations of your work?
• Have you discussed how your work leads forward to future work?
Evidence
• Is your evidence clearly presented, according to the standards of your discipline?
• Is your interpretation distinguished from your data?
• Do your conclusions follow from your evidence?
• Can someone repeat or replicate your work based on the description given in the paper?
Due credit
• Have you agreed on authorship and on the order in which authors are listed?
• Have you acknowledged the people who should be acknowledged?
• Are the citations accurate and complete?
Use of literature
• Have you cited the seminal text(s)?
• Have you cited the classic texts?
• Have you cited the foundational text(s)?
• Do you have at least five references on the first page?
• Do your references span the period from the seminal paper to last year?
• Have you included a reference which shows you know the literature which goes beyond the standard references for a particular topic?

(continued)

Table 12.1 Continued

Venue
• Have you decided on the venue? • Have you checked for deadlines (if applicable)?
Presentation
• Have you followed the guidelines for authors? • Are figures and references in house style? • Have you spell-checked the paper? • Have you used appropriate national spellings and punctuation (British or American)? • Do the headings provide useful and sufficient signposting? • Does your presentation conform to the conventions in your discipline?

Chapter 13

Presentations

• Content • Form • First impressions • Other handy tips

This chapter deals with 'live' presentations of your research in contexts ranging from conferences to job interviews. There are resonances between written and oral presentation – for instance, how to deal constructively with criticism, whether from reviewers (written work) or a live audience (oral presentations), how to structure the narrative, understanding your audience, and so on. The main thing that you need to bear in mind when doing presentations is the distinction between content and form, and is summed up in a variation on some song lyrics: 'It ain't just what you say [content], it's the way that you say it [form].'

Content is substance: ideas and results. If there is no content worth mentioning, then the best that you can hope for is to be viewed as entertaining. That does not help you in an academic research career, where you are assessed by your peers in terms of how much interesting content you have to offer. Speakers who give content-free talks can get pretty rough treatment from academic audiences. One such talk in an old university department was interrupted after ten minutes by one of the audience banging a fist on the table and saying, 'Are you going to say something worth listening to? Because if you're planning to continue with this bullshit then I'm leaving.' This is not the sort of reception that you should be aiming for.

Form is presentation: phrasing, pacing and delivery. The form is both instrumental and expressive: it can help convey the content (after all *communication* is the point), and it also gives information about what sort of researcher you are.

Just as different forms of writing require different styles and standards, different forms of presentation – research presentations, public speaking, teaching, tutorials, running a workshop, presentations for job interviews, business presentations – also have different rules, so you need to be careful about which rules you follow for which setting. This chapter focuses on presenting your

research; other formats are out of scope (but can be informed by the same basic ideas).

Content

Most presentations are divided into three parts. The classic advice is: 'First, tell the audience what you're going to say. Then say it. Then tell them what you've just said.' This is usually very good advice. The opening section sets the context, explains why your topic is important to the audience and prepares them for what comes next. The main section contains the main content and is usually the longest. The closing section summarises what you have just said. Each of these sections may have subsections, depending on the length of the talk.

The key determinants for content choices are: the audience, the time available and, of course, what you have that's worth saying.

Audience

Giving a highly technical presentation to an audience with only basic knowledge of the area usually results in a very bored audience. Giving a novice-level talk to a highly knowledgeable audience is embarrassing for everyone concerned. The best strategy is to consider the audience well in advance. If you're speaking at a conference, then look at previous proceedings, read the author instructions, talk to colleagues who have attended the conference in the past. If you're giving a seminar at another university, ask whoever invited you about the likely audience. If you're speaking at a workshop, ask the workshop organiser about the attendance list. Most organisers are only too happy to answer questions about the audience, and will treat such a question as a sign of professionalism.

Things you want to know about your audience include: how much the audience members are likely to know about your topic, what the typical level of expertise is (e.g. academic researcher in the same field, PhD student, professional practitioner) and what the typical orientation is (e.g. technical development or pedagogy). This helps you to decide how much general background you need to present and what level to pitch to. If you have a topic which is unfamiliar to the audience, then you need to lay the foundation and sketch out the key concepts. If you have to cover a topic which is already familiar to the audience, you can include just enough detail to show that you understand the topic, but move on fairly rapidly to material which is less familiar to them.

The purpose of presentations to other researchers is to demonstrate that you (a) know what things are like at the sharp end of research, (b) have been at the sharp end yourself and (c) have achieved something at the sharp end which will be of use to at least some other researchers. Unfortunately, these other researchers may not be in your audience. An important feature of research talks is that you will have to present your own results to professionals who will usually know a lot more tricks of the trade than you do, and who may be hostile (for instance, if you have antagonised them by giving a simplified account).

Questions at seminars are often viewed as a sort of academic blood sport, and some academics (although fortunately not the majority) enjoy scoring points by 'drawing blood', by finding fault in research presentations. Attempting to hide behind established wisdom won't help, because you should be reporting work too recent for any established consensus to have been reached. You therefore need to have your content right.

Time

There is only so much you can fit into the time available. It's probably less than you think. PhD students are likely to present their research in different formats that have very different lengths: seminars (usually around 45 minutes), conference presentations (20–30 minutes), lightning talks (5 minutes), posters (one sentence to 10 minutes), elevator pitches (one sentence). Time is the main constraint on content: the shorter the talk, the fewer the points you can cover adequately, and in less detail. That's important: a good presentation has a clear focus, culminating in at least one pithy take-away message. One clear point covered well is better than a hodgepodge of messages that haven't been substantiated.

It is essential to cover enough of the design and structure of your research for the audience to grasp its character. Too many students spend half a talk in introductions and preliminaries, wasting valuable time and demoralising the audience. Associate time with important points – points essential to convey the character and shape of your research, points important to your line of reasoning, points concerning the implications of your research, and so on. So, your talk should include the five classic key ingredients, which are the same as the key ingredients in a dissertation:

- **Research question:** including what motivates you to address it and why an answer will be important
- **Context:** what is already known, what the issues are, what other approaches have been tried or are being tried
- **Your research design:** what you're doing, what evidence you expect to find
- **Findings:** what evidence you have produced so far
- **Take-away message:** what you want the audience to remember about your research.

You'll need balance among these elements. Don't sacrifice the evidence, otherwise your take-away message won't be convincing (although in very short formats of 5 minutes or less, you'll only have time to indicate the evidence, not present it). Don't short-change the context, otherwise the research choices may not make sense (although context must be presented in a judicious way that frames the research, not like a literature survey). Don't forget to motivate the question, otherwise the audience might wonder why you're bothering. And so on.

Start by distributing half of the available time equally among the five – and then allocating the remaining half to the elements that are most important for

you to convey. A handy tip for timing is to have a master sheet in front of you which tells you which topic you should be covering at what time – for instance, '10.15 – slide about software failure rates'; an alternative is to mark your script or notes with timings. Rehearse the presentation and time yourself, then add or (more often) subtract material and try again until your timing is right. Note that many people speak faster to an empty room – so figure out if you need to allow for that. For short presentations, this is simple and effective. For longer presentations, it is not much fun rehearsing an hour's worth of material for the third time, so a better strategy is to rehearse once, adjust the amount of material if necessary and have a plan about which bits to add or leave out depending on how the time goes.

Sort things out so you don't need to look at your watch. Check time on-screen, find the clock in the room, or if you're good at reading people use the audience, whose expressions can signal how close you are to finishing time. The session chair may offer time indications; acknowledge them with a subtle nod.

The message

What's your 'take-away message'? Think of a talk as an extended abstract, rather than a full journal paper: your aim is to convey the unique character of your research, with enough detail so that the audience can grasp the Big Picture and understand what distinguishes your research from other related work.

Form

Form – the way in which you present your content – overlaps with content in places, but usually the distinction is fairly clear as well as useful. The form – and expectations on content – vary depending on the venue. Different venues may allow different amounts of time (which implies different constraints on the amount of content and the number of take-away messages), and may have different standards of rigour and hence different expectations about the evidence you present (e.g. workshops often welcome work-in-progress and accept preliminary evidence). Conferences (including student conferences) can be an excellent place to observe different presentation styles. In some areas, such as safety-critical systems research, widely different aspects of academia and industry are represented, and the audience can be treated to a succession of speakers using extremely different approaches to the same topic.

First impressions

The audience will usually have an impression of you before they even see you. They will have seen at least the title of your talk and probably a descriptive

paragraph about it. They may have scanned your website or other web presence. (Are these interesting and sending out the right signals about you and your work?)

The next thing the audience knows about you comes from the way in which you are introduced. An ideal start is an introduction such as, 'It's a pleasure to welcome Linda, whose work is already familiar to most of us here via her collaboration with Chris.' A less good start is when the person introducing you gets your name wrong and has to keep checking your details on a note card. If you take a proactive approach to your career, you can greatly improve your chances of getting the first sort of welcome. At the very least, try to meet the session chair and introduce yourself in advance.

The audience will also be forming impressions about you based on your appearance and behaviour. How formally are you dressed? How neatly? Are these both at an appropriate level for the setting of the talk? Appearance is a social cue; there may not be a dress code *per se*, but showing up as a slob can convey disrespect. You want the audience to be more concerned with what you say in the seminar than with some outrageous outfit you wear. If you aren't sure what the dress code is for your chosen venue, then find out. Go to departmental seminars and see how people dress. (There is an allegedly true story of a very eminent academic with little concern about fashion who was arrested for vagrancy early one morning on the steps of the British Museum, while waiting for that august institution to open. Extreme, perhaps, but it would have been a shame to leave the story out, especially since one of us was told it by someone who claimed to have heard it from the eminent academic in person.)

Slides

Audio-visual support can be an asset or a distraction. On the one hand, if the audience has only you to watch for an hour or so, they may begin to catalogue your hand gestures and count your nose hairs. Giving them good visual material encourages them to focus on the content, rather than on you. On the other hand, giving them poor visual material encourages them to focus on your typographical errors instead of your ideas.

Keep slides sparse and pithy. Beginners often try to put too much onto each slide. Slides are not meant to stand alone; they are meant to support a spoken narrative. If the audience is too busy trying to read your slides, then people won't be listening to your words. If you're reading from your slides, then you've turned away from your audience. The purpose of the slides is to focus attention and reinforce key points, not to reiterate fully, nor to provide a script from which you can read your talk. Use them to provide visual counterpoint:

- Illustrative photographs of the phenomenon of interest
- Insightful cartoons to underpin a key point
- Graphical presentation of essential results, etc.
- To indicate structure (e.g. simple concept maps; short bullet lists of key ideas; a list of steps in a process, etc.), or
- To present results which take time to describe and discuss.

You need to use large print so that the slide will be readable at the back of the room, and white space so that the audience isn't overwhelmed by indigestible masses of information. Tables of results are a traditional problem in presentations: usually the figures in the tables are too small to be readable at the back of the room. It's a good idea to check the readability of your slides well in advance. For seminars, it's also a good idea to prepare a handout which complements the slides – most audiences appreciate a one-page handout of connected text covering your key points and a hard copy of the slides, with the slides reduced to a sensible point size so that they can scribble notes on the hard copy during the presentation.

What sort of script?

Different people use different sorts of scripts or notes to guide their talks. Think about what sort of script will support you best.

- **Slides:** your slides should be a distillation of the key ideas in the talk. If you're scanning them from a printout or your laptop, while facing the audience, they can provide cues for your narrative
- **Notes:** people keep notes of points they want to make, in the order in which they want to make them. Some annotate a copy of the slides to include fuller information and an indication of the 'story' they want to tell about the overheads. Others keep a separate 'text', with indications of how the slides relate to the notes
- **Full script:** some people write a full script for the talk – not necessarily to read it (which is not a good plan), but to have a set of words to fall back on if they 'dry up'. Presentation software such as PowerPoint usually provides a 'presenter view' that allows you to see both the slides and your notes or script
- **Time line:** it's a good idea to know how your talk fills the available time, so that you know how much material you should have covered by the halfway mark and so on. If you have a script, or a set of notes, or just a running order, you can annotate it with target times. Then you can check your progress during the talk.

Mechanics

Volume

You need to speak clearly enough and loudly enough to be understood at the back of the room. It's a good idea to check that you can be heard at the back of the room; it's a bad idea to do this by saying, 'Can you hear me at the back?' because of the risk of some comedian replying, 'Yes, unfortunately.' Beginners often start in a shout and then revert to a mumble after a few minutes. A simple way to reduce this problem is to write a reminder to yourself on your master sheet (e.g. 'Slide 2: are you mumbling?'). Another is to identify a comfortable face in the back row and pitch your voice for that person. A more difficult strategy, but one which is invaluable for many purposes, is reading your audience.

Technology

It is a good idea to become familiar with audio-visual equipment well before your presentation – learn how to use as many varieties as possible. If you're presenting from a laptop, ensure that you have the power lead, any connectors required, and a USB stick with a copy of your presentation (in case of laptop disaster). Sort out the audio-visual equipment at the venue in advance of your talk. Also, assume that the equipment will cause problems and have a fallback plan ready. Technology goes wrong; a surprisingly common spectacle at conferences is the presenter staring at an empty screen and saying: 'But I checked it on my laptop five minutes ago and it was working perfectly.'

Position

Find a good spot to stand. A classic mistake is to stand between the audience and the screen, so that you cast a shadow across the screen and have tables of results showing all over your face. Get into the habit of standing to one side of the screen. You should also get used to pointing at parts of the slide on the screen using your shadow, or a laser pointer.

Reconnaissance

A moment spent in reconnaissance is seldom wasted. If possible, check the room where you will be giving your presentation, once from your point of view and once from the audience's point of view. From your point of view, what equipment is there and do you know how to use it? How much space is there for you, for things like standing to one side of the screen? Are there trip hazards such as tangled cables on the floor? Can you see the audience clearly enough to read expressions at the back of the room? Is there space to put your bag, slides, etc.?

From the audience's point of view, how visible is the screen from different parts of the room? If visibility is bad, and you have the chance, then consider distributing hard copies of your slides so the audience won't miss anything, and remember to tell the audience that you are giving them hard copies of the slides (a lot of people won't bother to look at the handouts until the end, or a boring bit). Are there glare problems anywhere?

Tools

It's a good idea to have a bottle of water to hand. Nerves can produce 'dry mouth'. It's also a good idea to have a pad and pencil, or electronic equivalent – in case you need to make note of a question that you defer, or of some useful comment from the audience.

Reading the audience

Reading your audience involves looking at the audience and assessing their response to your presentation.

***Classic bad signs are*:**

- People looking out of the window
- People telling jokes to their neighbours
- People shaking their heads
- People at the back craning forward to hear what you're saying
- People at the back asking their neighbours what your slide says
- People looking at their watches or the clock.

***Classic good signs are*:**

- People taking notes
- People nodding when you make a point
- People whispering to their neighbours while looking at your slides or handouts in an interested way
- People looking at your slides or handouts in an interested way.

You need to send out to your audience the signal that you are a professional with a thorough grasp of the subject matter. You can send out some positive signals about this in the same way as when writing. For instance, when you quote one of the classic texts, you can mention in passing a more recent, more sophisticated critique of that classic text which is not widely known except among academic heavyweights.

Audiences who meet frequently (e.g. at departmental seminars or on a well-established conference circuit) often exhibit behaviour which looks odd to an outsider, as a result of group dynamics and history. For instance, someone may take an afternoon nap and snore – as happened to one of us in her first seminar. Or, a senior figure may savage an inoffensive presentation by a good and unsuspecting student as part of a long-term vendetta against the colleague who supervised that student. This will usually trigger off a retaliatory strike by the supervisor, and within seconds the scene can resemble the academic equivalent of a spaghetti Western – a sleepy Mexican afternoon one moment and a high body count the next. An interesting aspect of this is that many members of the audience will be quite unaware that this carnage is going on, because it will be couched in academic language inscrutable to outsiders. (For instance: 'I presume that you allowed for the anchor and adjust heuristic in the design of your instrument?' 'There was no need for that, because a frequentist presentation was used, due to the inherent problems associated with single event probabilities.') In general, stay calm and don't over-react to unexpected behaviours.

Other handy tips

It's a good idea to get as much experience as possible of presentations by attending other people's – for instance, the departmental seminar series. Even if the topic of this week's seminar is utterly unrelated to your work, it's worth

going if only to find out how other people do things. (There's also a good chance that sooner or later you'll encounter something from another area which has major implications for your own area.) If the content of a talk is of no interest to you, you can use the time to make notes on any tricks of the trade which the speaker uses, or any mistakes which the speaker makes, so that you can improve your own style. Notice the craft of well-designed slides, effective background summaries, well-fielded questions. One of us learned a great deal about skilful presentation, with particular regard to scaring off questions before they were even asked, during a seminar on learning in rats. Learn how to deal with interruptions (if it's a short clarification question, answer it in the moment; otherwise note the question and defer it to the end).

Attending other people's presentations, especially during the first few weeks of the new academic year, is also a good way of learning about professional etiquette at such events. Watching someone being savaged for asking a naïve question, or for giving a naïve talk, is painful, but it's a lot less painful than being savaged in person. You can learn what your peer group's attitudes are towards things such as falling asleep during a presentation (usually considered bad form, but occasionally used as a studied insult), asking hostile questions (frowned on by some groups, venerated as an art form by others) and knitting (usually viewed with ambivalence).

Dealing with nerves

- **Preparedness:** being really well prepared won't stop you being nervous, but it will help. If you've given a practice talk that was well received and that allowed you to sort out any glitches, then you're likely to be more confident in the conference presentation
- **Crib sheets:** if there's key information you want to remember (e.g. key papers and who wrote them), then write yourself a 'crib sheet' (i.e. list of the key facts and points) that you can take along for reference in case you need it
- **Anticipate your fears:** think through the things that worry you most. What's the worst thing that could happen? How might you deal with it? Ask someone else how they'd deal with it
- **Find a friendly face in the audience:** it's easier to make the talk warm and conversational if you can view it as a conversation with someone – especially someone who is interested
- **Pause for breath:** pauses during a presentation feel to you like they last for years, but the audience hardly notices them. Allow yourself pauses to think, to collect yourself, to catch your breath. Your talk will be better for it
- **Introduce yourself as a student:** if you're really terrified, you can slip in the information that you're a student in a bid to get the audience to treat you gently. For example, you can credit your supervisor, and you should credit your funding body, if appropriate
- **Study the question patterns in preceding talks:** many people ask the same sorts of question of all speakers (e.g. methodology, statistics, application,

relationship to particular theories). So, if you have a chance, pay attention to what sort of audience is in attendance and consider how you'd answer similar questions focused on your talk

- **Dress comfortably:** you'll have enough to think about without being distracted by shoes that pinch or clothes that feel inappropriate. So wear something that makes you feel good.

Handling questions

You don't have to disagree with a critic. You can say: 'That's a really interesting point, and I don't think it's been properly addressed in the literature.' You have shown yourself to be courteous and open-minded, and ready to take on board what the critic is saying; you are also implying that the omission is common to the literature in the area, rather than a failing on your part.

If your audience points out something which appears to be a genuine flaw, then thank them for it, go away and test out what they've said – they may be right, and if so the sooner you fix the problem the better. In such cases it's a good idea to ask them to work through the implications as a response to their question – it might well be that they are wrong, or bluffing, and if so this will become apparent in their response to your courteous reply.

Hypothetical example: you have just described a methodology for eliciting information about the beliefs and values of socially disadvantaged groups. Someone at the back of the audience says that you might find that the literature on requirements acquisition already covers this in more depth. You ask them politely to give an example. Response 1: 'Oh, I'm sure you'll find lots of examples in the literature.' Response 2: 'Well, for a start, there's the problem of missing various forms of semi-tacit and tacit knowledge, such as preverbal construing, taken for granted knowledge and implicit attitudes.' Response 1 is quite possibly a bluff. Response 2 is either an extremely elaborate bluff or an indication that what you thought was a harmless squirrel in the bushes is actually a large bear.

Here are some useful concepts for handling questions:

- **Practice:** if you've given the talk before (e.g. to an *ad hoc* audience of students), you'll already have met some questions and had the experience of being 'on the spot'. This will help
- **Question patterns:** during seminars and other people's talks, pay attention to the sorts of question that people ask. See if you can discern patterns in what people ask about. This gives you a basis for anticipating questions that might arise after your talk, and you can prepare answers for those
- **Fending off references to unfamiliar literature:** if you don't know the paper you're being asked about, you can throw the question back to the asker: 'I'm not familiar with that paper; what point does the author make?' Or you can ask the questioner to relate it to literature you *do* know: 'I'm not familiar with that paper; does it fall into the AI camp or the empirical studies camp?'

or, 'Is that anything like the travelling salesman problem?' Don't fake it. Make a note of the questioner and ask for the citation after the session

- **Technical questions:** divert overly technical questions to private discussion: 'That's an interesting point, but it would take a while to answer. Could we discuss it at the break?'
- **Missed questions:** if you're not sure you've understood the question, then paraphrase it back to the questioner: 'If I've understood you correctly, you're asking me if . . .' and then answer *your* version. If you haven't followed the question at all, ask the questioner to repeat it – he or she may ask a simpler version
- **Long questions:** have paper and pencil ready. If someone asks a multi-part question, or passes off an essay as a question, then making some quick notes will help you keep track of what you want to say in response
- **Bizarre questions:** treat these similarly to overly technical questions; something along the lines of, 'That's a very interesting point, and one to which I hadn't previously given much attention. I'll look into that once I return to the office.' *Don't* offer to discuss it in the break.

Get someone else to record the questions asked, preferably with the names of the askers. You're unlikely to just remember them and you may not have time to make notes. In general, it's a good idea to be prepared to take notes – of people to catch later, or of particularly good points (theirs or yours), or of things you want to follow up.

Have comfort food and bandages ready

The world is not fair. Sometimes people will be gratuitously and unnecessarily rude to you even when you're in the right. Sometimes you won't think of the brilliant and correct riposte until years afterwards. It happens. Sometimes the comments are justified. On other occasions, the fairness of comments is more debatable. Here are some examples which happened to other people:

- Opening line in question from audience at conference (witnessed by one of us): 'That was the most ignorant and ill-informed talk I have ever heard.'
- Suggestion from audience in conference to someone else in the audience who complained with gratuitous rudeness that the speaker's recommended approach hadn't worked for them (witnessed by one of us): 'Perhaps you should try doing it right.'

A good strategy (once you're out of the danger zone) is to feel utterly sorry for yourself for the rest of the day and seek solace in comfort foods and your personal equivalent of bandages – a small sherry, chocolate, watching a movie with a high body count, or whatever, thus giving your psyche a chance to sort itself out. Then, the next day, ask yourself what you're going to do about it and how you're going to move on. Were the comments a fair hit? If so, you need to

work out how to fix the problem. If not, what are you going to do to reduce the risk of similar unfair hits in the future?

A closing point about strategy and fairness: although it isn't a fair world, there are quite a lot of fair people in it. If you're perceived as a nice person who does good work, rather than an embittered seeker after petty revenge, then more experienced researchers will be likely to talent-spot you and to put opportunities your way. This is something which doesn't usually happen to people who spend their lives in pointless wrangling.

Our advice is designed to help you deal with familiar challenges of public speaking, so that you can cope with them effectively. Remember: criticism can be profoundly helpful, and you should engage with it constructively (however it is offered). But don't assume that presenting your work will be a terrible experience; many audiences are engaged and constructive – and you may be pleasantly surprised by the perspective and insight they bring to your work.

Table 13.1 A brief checklist for presentations

- Have you checked the level of detail at which to give the talk?
- Have you checked what the audience will already know?
- Have you rehearsed the talk and checked the timing? Have you rehearsed it with an audience?
- Are your slides readable?
- Do you know how to use the audio-visual equipment where you will be presenting?
- Have you looked at the room where you will be presenting?
- Do you have a master sheet showing where you should be at which stage of the talk?
- Do you have a backup plan in case of equipment failure?

Remember the three golden principles: don't lie; don't try to be funny; don't panic and blurt out the truth.

Chapter 14

Conferences

• The conference process: a novice's perspective • The organisers' viewpoint • Miscellaneous good advice • Getting the most out of networking at a conference

Researchers have three main ways of keeping in touch with what is going on in their area of research. A swift and efficient way is the grapevine – if Smith and Jones have solved the most important question in their field, then most of the major players in that field will know about it within a few hours of the news going public (and probably much sooner, given the way that gossip works). This is fine if you're a major player with good connections to the grapevine, but not so fine if you're a struggling PhD student who still has an uneasy suspicion that the major texts in your field are produced by superhuman figures who live somewhere on the middle slopes of Mount Olympus.

A more feasible way of keeping up to date for most PhD students is journals. Unfortunately, the lead time for journal papers is about two years, so the journal freshly appearing on your library shelves will contain accounts of work done about three years ago.

However, help is at hand in the form of conferences. Every year, most research fields have conferences at which researchers from around the world meet to present their work and to listen to other people's presentations. They also, more importantly, socialise and build their social networks. A conference therefore gives you the chance to find out about research which is no more than a year old, and is probably considerably more recent, as well as a chance to meet colleagues from around the world.

So how does this translate into specific things that you need to know? We shall start with the process, from the viewpoint of the absolute novice, then move on to the process from the viewpoint of the long-suffering organisers, and conclude with some advice.

The conference process: a novice's perspective

There are two capacities in which you can attend a conference: as someone presenting work, or as someone who is not presenting work. For simplicity, we will proceed with the assumption that you are presenting work, since this includes what you need to know about being in the audience.

There are different reasons for targeting a particular conference, some (e.g. engaging with a particular community, choosing the main conference in the field) more professional than others (e.g. wanting to visit an exotic destination). By a fascinating coincidence, the main conferences are surprisingly often held in desirable destinations, and are in consequence able to be very selective about which papers they accept.

Whatever the reason, one starts with the call for papers for that conference, which will specify which types of paper will be accepted, state the guidelines for each type of paper, and give the deadlines for each. The main types usually include some or all of the following:

- **Full papers:** what they sound like – full-sized papers
- **Short papers:** also what they sound like – short papers, often used for less mature or significant work
- **Abstracts for papers:** some conferences don't publish proceedings, or only publish selected submissions in a journal special issue. The main risk about being accepted on the basis of an abstract is that you will have to live up to the wild claims that you made in the abstract in the hope of being accepted
- **Posters:** where you stand in the lobby at coffee and lunch breaks next to a poster which you prepared in advance, describing your work to anyone who pauses to ask.

There are often other types of submissions, too: work-in-progress papers, papers at an associated workshop, experience reports, position papers, etc.

The submission routine is similar to that for journal papers (Chapter 12), but sometimes the standard of reviewing is more relaxed (or non-existent), and often the decision is 'yes/no', with no iteration for revisions and re-submission. If there is the opportunity for revision, it will probably come with a tight deadline. Acceptance is always contingent on at least one author registering for the conference.

Acceptance also entails logistics: funding, registration, travel and accommodation arrangements. Think ahead; delays can create expense and obstacles. You may face some interesting challenges about how to persuade The System to pay for your travel, conference fees and accommodation for a week in the Hawaii Hilton. If you have not previously checked with The System whether this is OK, then you will be asked to explain just why The System should fork out a couple of thousand pounds for you to have a nice holiday, and how the department benefits. A wise supervisor will have made sure that the funding for your PhD includes allowance for a conference per year; but this allowance

may not stretch to a major conference in somewhere exotic. If the funding is approved, you need to arrange registration, travel and accommodation. If the conference is in another country, you may need to apply for a visa. If you have acquired a reputation as a pleasant and reasonable person, you may discover that one of the secretaries or research assistants is willing to help with such arrangements; if you haven't acquired this reputation, you probably won't make this discovery, and may end up without the means to travel, or staying somewhere more characterful than you might like.

What happens when you arrive? You follow the signs for your conference; if your conference has more than one set of signs, then you follow the ones marked 'registration'. At the place of registration, you will usually be issued with a badge, a programme of events and a pack of information; from this point on, you can follow the crowd, and not have to make any decisions for the immediate future. There is a non-trivial possibility that the registration people will claim never to have heard of you, especially if you left booking until the last moment, which is a good reason for (a) not leaving everything until the last moment, (b) bringing copies of receipts and confirmations, and (c) going with someone who is familiar with conferences. Problems of this sort usually get resolved somehow, but they're something you can do without.

Working a conference

Once you've committed to attending the conference, it's time to do your homework. Most conferences publish preliminary programmes on their websites as an inducement to get more people to attend (if not, you'll have to do this homework in a quiet corner when you reach the conference and receive your conference pack). You need to pay attention to the following:

- **The attendees list:** who's on the list that you'd especially like to meet? Are any of those people giving a paper?
- **The sessions and paper titles:** plan your attendance. Which sessions are not to be missed? When are there openings for conversations? Who is the first contact you want to target?

If there are key people attending the conference that you want to meet, you might want to start laying the groundwork early. Is there someone attending the conference that you know and who could introduce you? Is there a particular question you'd like to ask that researcher which you could address in an email? (The researcher may not answer, but if the question is interesting the researcher might be more prone to give you a bit of time when you meet at the conference.)

Once you have your conference pack, really use it. First, find yourself a suitable quiet corner and continue your planning about which sessions to attend. It's usually a good idea to attend the plenary sessions. Many conferences use two or more lecture halls so that two or more talks can be in progress simultaneously ('parallel streams'), in which case you'll need to decide which stream to attend. You don't have to go to every talk every day (and sometimes

a strategic conversation over coffee with the right researcher is more valuable than a paper session), but you won't learn anything from talks you don't attend. Each night:

- Skim or read the papers for the sessions you plan to attend the next day
- Have a look at the papers for the other sessions (you may meet their authors at coffee)
- Check your plan for the next day.

Each day, take your proceedings to the sessions and:

- Refer to papers for clarification
- Annotate the papers: for instance, if the authors add information during the presentation (there are often extra website addresses that are handy to file with the papers), or if there is something specifically resonant with your own work
- Work out questions to ask
- Have something to do (i.e. read other papers) if the session turns out to be a dud
- Pay attention to what makes good speakers good (and bad speakers bad).

Learn the 'moves' for introducing yourself to someone you haven't met before (see the strategies at the end of the chapter). Remember that other people at the conference may feel equally ill-at-ease, and make it easy to engage in conversation with you by offering relevant observations and questions as 'openers'. Many conferences have 'newcomers' sessions, doctoral tracks, and workshops for early career researchers; avail yourself of them – they often provide opportunities to meet key researchers who value students.

What you get out is related to what you put in. If you 'work' the conference – staying engaged, seeking conversations, keeping track of information – then you're more likely to make good connections. Remember, much of the 'real' value of a conference isn't derived from the sessions – it comes from conversations in the bar. If you don't drink alcohol, then remember that bars also serve non-alcoholic drinks, and that there are coffee and lunch breaks where you can also get a chance.

We now move for a little while to the organisers' viewpoint, which should help you to understand the niceties of conference procedure more clearly.

The organisers' viewpoint

Why do people organise conferences? There are three main reasons: fortune, glory, and (in quite a few praiseworthy instances) the good of the discipline. A good conference can bring in a substantial profit to the institution involved, and can bring recognition and power (within research circles at least) to the

academics organising it. A well-planned conference can also be an excellent way of revitalising an area of research which has gone stale, or of starting a new area of research.

One of the first problems to tackle involves how to attract enough people to make the conference viable. A standard solution is to invite some key speakers, whose talks will be a significant attraction. This is particularly effective if one or more of the keynote speakers gives a talk which either summarises the current state of the field or (preferably) suggests some really interesting new ideas. A nice venue is another attraction worth trying. The third classic attraction is to publish the conference proceedings; an added enticement is to strike a deal with a journal editor to publish the best papers in a special issue of the journal. This is a significant inducement because departments fund conference attendance based on return-on-investment. Publication is a return; prestigious publication is a better return.

Managing the logistics of the conference demands prompt and complete information from presenters, in order to organise the various papers and events into a coherent conference schedule, work with the printers within their (often tight) production constraints, and work with the conference venue to assign facilities. Any slip in organisation normally costs money. So as an organiser you might be less than sympathetic to authors whose copy is not submitted on time, or is submitted electronically in a format which nobody outside Nebraska can read. Even if all the advance arrangements run smoothly, the presentations themselves leave considerable scope for interesting things going wrong. Talks are normally grouped into sessions. Sessions often overrun, perhaps due to starting late because speakers trickled in at the last possible moment, perhaps due to equipment malfunctioning, and mainly because of speakers overrunning by two or three minutes – not a big deal individually, but multiply that by the number of speakers and the over-runs accumulate.

The implications for you as a presenter are clear:

- Submit your copy in plenty of time
- Follow instructions for authors
- Practise your talk so that you can keep well within your time slot
- Be considerate and try to see things from the organisers' viewpoint
- If you encounter problems, let the organisers know as soon as possible, so that something can be arranged.

Miscellaneous good advice

Your very first conference is a glittering opportunity to make a complete idiot of yourself in front of the main players from your research community before you've even finished your PhD. There is, unfortunately, an asymmetry: there is not much scope for making yourself look amazingly wonderful to the same audience, for the simple reason that at this stage in your career you will probably

not have anything remarkably novel and interesting to say. (Interesting, yes; novel, yes; both interesting and novel is a possible combination; *remarkably* interesting and novel is much rarer.) Some classic ways of making an idiot of yourself include the following:

- Getting drunk in public
- Being sick in public as a result of a hangover from getting drunk in private
- Having wild sex with someone in the fond belief that (a) nobody else will know or (b) that it won't matter – in reality, everyone will know by coffee break the next morning and your bedmate will probably turn out to be a dreadful mistake
- Asking the same inane question that gets asked every year by new PhD students who think they're being original.

Your first conference is a good opportunity to practise your listening skills, even if you're sure that you have a brilliant solution to the problem that's bugging everyone. If you're right, then you'll still be right tomorrow, and learning to be patient is an invaluable research skill. (So is getting your idea into print, rather than blurting it out in a conference and then seeing it appear under someone else's name a few months later . . .)

Your first conference is a good chance to meet people and strike up friendships which might well last for the rest of your professional life. The best way to do this is over conversations, with people who are willing to talk to you (the keynote speakers and other major players may be willing to talk to you, but are understandably wary of being buttonholed by every loon at the conference, especially if the major player in question has come to the conference for a long-awaited chat with a close friend from several thousand miles away whom the major player hasn't seen since 2002).

If your first conference is also the first conference at which you are presenting a paper, then you might be excused for feeling a bit stressed. One good way of reducing the stress is to get some experience at public speaking before you go – for instance, departmental seminars, which should be treated as a useful opportunity rather than as an unwelcome obligation to be avoided till the last moment. You can also try running unofficial postgraduate seminars at which you present your work to each other in a constructive, supportive atmosphere (persuading a wise and supportive member of staff to come along and give constructive criticism can be very helpful). Another strategy is to co-author with your supervisor and persuade your supervisor to give the talk, with a promise that you will do the talking next time. You can then learn from your supervisor's experience. If you are talking, then it's a good idea to read the chapters elsewhere in this book on writing and presentations. At this point in your career it's wisest to go for an unpretentious, solid talk which reports what you did in a level tone, neither claiming too much nor too little. Your mission is not to entertain or dazzle the audience – that's the job of the guest speakers. Your mission in your first conference is reconnaissance, so that you'll know what you're doing at your second conference.

Getting the most out of networking at a conference

Strategies for covering conferences of different sizes

- **Small:** aim for comprehensive coverage (i.e. talk to everyone there).
- **Medium:** aim to talk to as many people as possible, but target those doing related work.
- **Large:** make advance arrangements to ensure contact with key people, and target during the event (while remaining open to serendipitous conversations).

Making contacts at the conference

- Use activities (workshops, working groups, tutorials, 'birds of a feather' sessions, first-timers' events).
- Present a paper (which introduces you to everyone in your audience).
- Ask a good question (others who find your question interesting may introduce themselves to you, and the author will be more likely to remember you).
- Attend demonstrations.
- If you hear a conversation that's really interesting, stand visibly on the periphery until you get a chance to make a contribution (a short question or a joke is good) or ask if you may join the group.
- Get your supervisor or an existing contact to suggest people and make introductions.
- Make early contact with a key person (e.g. someone on the committee, someone well established in the area) and be around when that person makes contact with others; ask that person to make introductions.
- Talk to the person sitting next to you in a session – ask a question about the last presentation.
- Make it a habit to have lunch with different people every day.
- Make connections for other people – refer to other conversations and work and be ready to make appropriate introductions.
- When you're in a conversation, avoid 'sounding off' or entertaining people with your opinions – it's much more effective to phrase ideas as questions rather than statements.

Have your 'cocktail party introductions' (i.e. brief description of who you are and what you're researching) worked out and ready to mind. Take your business cards and write some specific information on the back that will help your contact recall your conversation. When you take someone else's card, write down where you met and some characterising idea or expertise that will help you remember that person in six months.

Following up

- Conference contacts tend to have a high attrition rate – but making contacts is still worth it if you make one good, lasting connection
- Make a note of whom you've met, the context, and what you discussed – if someone hands you a business card, annotate it
- Always keep the promises you make: do send that paper, or email that information
- Follow up great conversations with a thank-you email
- Suggest visits or specific further interaction to good contacts
- Invite good contacts to your institution – perhaps to give a talk
- If you didn't get a chance to speak to an author during the conference, do it via email afterwards.

Chapter 15

The viva

• Stories of nasty surprises • Behind the scenes • The day of the viva • Preparing yourself • Handling revisions • The viva: hints, lists and things to remember

The viva (short for *viva voce* or 'living voice' examination) occupies a place in PhD student myth and legend which offers immense scope to writers with a taste for scary metaphor, but tact and common humanity prevent us from exploring that area as fully as we might. In one sense, the folklore is right. The viva is one of the two essential outputs from your PhD. If your written thesis and your viva are both good enough, then you get a doctorate. If they're not, you don't. Nothing else comes into play – not how hard you've worked, or how much you care about your topic, or how much you've suffered, or how much you want that PhD. It's perfectly possible to write a decent dissertation and then make a disastrous mess of the viva. So, what do you do about it?

Remember what you're doing in the viva:

- Showing respect for the academic system and discipline
- Showing sufficient mastery of the domain and its intellectual tools
- Demonstrating intellectual independence
- Joining the academic discourse
- Undergoing a rite of passage.

The first thing is to understand the purpose of the viva from the examiners' point of view. The PhD is a rite of passage, showing that you are worthy to be admitted to the clan. In terms of the cabinet-making metaphor, it's the point where you leave apprenticeship behind and become a fully-fledged cabinet-maker, if you're good enough. The key point in both metaphors is that neither of them contains any mention of perfection. PhDs don't have to be perfect – they only have to be good enough, where 'good enough' means that you have demonstrated

a satisfactory command of the skills required for a professional researcher in your discipline. The level of 'good enough' will be high, but that's different from perfection. Nobody will be expecting your thesis to be perfect – in this context, the whole idea of perfection is only meaningful as a convenient shorthand term. By definition, when your work involves new discovery, there is uncertainty and no absolute right answer. Your work will build on previous work and on established techniques; all of these are ultimately derived from approximations, assumptions and consensus in the field, rather than from definite absolute truths. Part of becoming a mature professional researcher is being able to accept uncertainty, and to deal with it in a way which is appropriate for the situation in hand. Sometimes an uncertainty is the whole point of the research (for instance, 'Why is this mould growing on my petri dishes?'), but on other occasions you have to accept that you have to live with an uncertainty which is not likely to be clarified in the foreseeable future (for instance, 'Why do things so often form Poisson distributions?').

The obverse of this cheering thought is the implication that your thesis will contain *questionable things*. These provide a starting place for the examiners to do some poking around, to check the extent of your skills. They don't want nasty surprises. They want to be reassured that your mastery of your field holds up adequately under scrutiny. They do not want to discover that your thesis is brilliant because your supervisor wrote all of it for you under the influence of desperate, unrequited love. They do not want to discover that you didn't mention an obvious point because you'd never thought of it, rather than because you didn't think it was worth mentioning because it was so obvious. Two stories illustrate this. (We have chosen stories which are probably apocryphal, so as to spare the feelings of those involved in definitely true stories.)

Stories of nasty surprises

The mushroom story

The mushroom story concerns an agriculture student whose undergraduate dissertation involved looking at growth in farmed mushrooms, a topic of little interest to most of the world, but of considerable importance to mushroom farmers. Much to his surprise, he found that the mushrooms did not grow either continually or in diurnal cycles; instead, they grew in cycles of a few hours. This finding was so unexpected that he went on to do a PhD on the topic, producing large amounts of data and analysis. The day of the viva arrived, and went beautifully up to the point where the external examiner asked a gentle, ground-clearing question, namely: 'I take it that you allowed for the heating going on and off in the mushroom sheds?' After some seconds of horrible silence, it was agreed that the viva would be postponed until after the student had done a post-pilot study to check this possibility. The results of the post-pilot were sickeningly predictable: the student had just spent several years measuring, in effect, how often the heating went on and off in mushroom sheds.

The woodpecker story

The woodpecker story is similar. We include it partly on the grounds that it's wise to be wary of principles which are always illustrated by the same example – this raises the nasty suspicion that there is only one example – and partly on the grounds that one of us used to wear a safety helmet in the course of a previous day job and can personally testify that they come in very handy when someone drops a bucket on your head. The woodpecker story is also useful because it demonstrates a more subtle and far-reaching effect than the mushroom story.

According to the story, the developers of safety helmets decided to look to nature for inspiration. One of them wondered whether there were any animals which experienced powerful blows to the head without suffering brain damage. Inspiration struck, in the form of the woodpecker, which spends much of its waking life banging its head against trees with considerable force. The team accordingly read up on the anatomy of the woodpecker and discovered that it has a spongy base to its beak which absorbs the force of the impact. The team used this inspiration to come up with a design for a helmet which was not designed to stop objects from penetrating the helmet, but instead was designed to absorb the blow by deforming harmlessly, preventing most of the energy of impact from reaching the wearer's head. The designers were proudly demonstrating their concept when, according to the story, a member of the audience asked: 'How do you know woodpeckers don't suffer brain damage?' Painful silence ensued . . .

In the mushroom story, the student failed to identify a relevant variable (the heating). In the woodpecker story, the design team had not checked a key assumption (that woodpeckers don't get brain damage). The woodpecker story in fact had a happy ending; the current design is demonstrably good and the designers were proved right (even though, as far as we know, nobody ever did check on brain damage rates in woodpeckers). In other cases, however, unchecked assumptions have led to years wasted on pointless research, which could have been spent instead on something better. This is quite a different proposition from reducing the problem space by eliminating one set of plausible possibilities.

For this reason, external examiners are likely to poke around in the foundations of your research, checking that you have neither missed anything which you should have thought of, nor made an unwarranted assumption. An example from popular culture illustrates this. According to the story, The Incredible Hulk was created when a mild-mannered scientist was trying to find the source of people's astonishing strength in emergencies, such as the woman who lifted a car off her child after a crash. That story is fiction and silly, because – dramatic pause – people *don't* have astonishing strength in emergencies; the story of the woman lifting a car off her child is an urban myth. (Try checking the website www.urbanlegends.com if you're thinking of applying for a research grant of your own in this area, before you start budgeting for high-stretch shirts and non-rip trousers . . .)

Most students hear numerous horror stories about vivas. In our experience, failure at viva is rare and is almost always attributable to one of two things:

1 The student didn't listen to their supervisors, or any other advisers for that matter
2 The supervisory relationship had broken down and the student hadn't compensated for it.

Therefore, failure at viva is in principle avoidable, given two protective behaviours:

1 Listen to your supervisor
2 Build up an effective personal network, and expose your work through seminars and publications in advance of your viva, so that you'll be alerted to oversights early.

Behind the scenes

So, the examiners are there to check that you know how to make cabinets; how do they do this?

The story normally starts before you see them. At some point in your PhD, you and your supervisors need to choose an internal and external examiners. For some PhDs this is done before you even register for the PhD; for others it happens after you've written up. For most it's somewhere in the last year or so. There are various factors in choosing the examiners. They should not have a conflict of interest – if they're co-applying with you for a Nobel Prize, for instance, then they will have a substantial incentive to pass your thesis, whether you deserve it or not. Similarly, if your last conversation with them started with you saying: 'Wake up, darling, or we'll be late for my viva,' then questions might be asked . . .

Once the examiners have been chosen, they will get on with their lives until your thesis arrives in the post, accompanied by the appropriate forms and other paperwork. What do they do with it? That depends. Most examiners will read the thesis in detail, at least once. Many will read it line by line, making notes page by page. They will look in detail at the references and appendices (the equivalent of hauling the drawers out of a cabinet and checking the joints that were never intended to be seen in normal use). They will check references or assertions which don't look right. They will probably spot the reference to a fictitious paper by Young, Gifted & Black (1972) which felt so amusing at the time. And so forth. At the other end of the spectrum, there are persistent stories about externals who read theses on the train, on the way to the viva. Either way, you want their initial reaction to be the same: you want them to feel the nice warm glow that accompanies the thought: 'Well, this doesn't look like a fail.' So, make sure that the pages which they will look at first are all reassuring – all the pages up to and including the second page of the introduction, the references, and the concluding couple of pages.

The examiners will usually read the thesis independently and then contact each other to discuss it. They have a limited set of options about marks, since

you either get a PhD or you don't: you don't get a percentage mark like you do with a final-year project. However, this apparent simplicity derives from a more complex assessment process. The examiners can pass your thesis without changes (unusual, but far from unknown); they can fail it completely (far from unknown); they can recommend that it be considered for an MPhil instead; or, more commonly, they can accept it subject to specified changes of varying degrees of severity. If they agree that it looks like a straight pass, a straight fail or an MPhil, then their life is simple; more often, however, there are changes required, which means that the examiners have to discuss what needs to be changed. This can be time-consuming and irritating, especially if the changes are needed because your thesis is vague or otherwise badly written. After this, they will need to agree on the game plan for the viva itself – who will handle which bits, and how? Note that they don't simply put together a list of changes ready to give to you. The provisional list will be modified in the light of the viva. If it turns out, for instance, that an apparent problem is simply a matter of your using an unusual name for something instead of a more familiar one, then the change might only involve putting in a parenthesis to explain that your term means the same as the more familiar one. Conversely, if the viva reveals major and inexcusable ignorance on your part, then what initially looked like a minor change can turn into a major one, or even a fail. This shouldn't normally happen, but it may happen in cases where a student vanishes into the wilderness, does some research, then writes up and insists on submitting against the advice of their supervisor (rare, but unfortunately not unknown).

The day of the viva

The examiners normally rendezvous in or around the department some time before the viva, and have a pre-viva meeting to confirm their plan of action. They will usually not show much interest in meeting you at this stage. This is nothing personal: they have a job to do, and they need to concentrate on that. Many vivas are held in the afternoon, to give the examiners time to get to the venue; in these cases, the examiners are normally taken off to lunch by your supervisor before the viva. You probably won't be invited: this is etiquette, not a snub. (You may be invited to lunch if you had a successful viva with them in the morning, but that's different.) There are persistent rumours about cases where the supervisor treats the examiners to a few drinks at lunchtime to get them in a good mood; if true, this is the exception, not the norm.

When they are ready, you will be summoned, and will go into the room, looking and feeling distinctly nervous if you are anything like most other PhD candidates.

Opening gambits

Since you are likely to be nervous, most examiners will make an effort to put you at your ease. The bit where they introduce themselves will usually go past

you in a nameless blur, like the following bit where they say how they are going to conduct the session. There are various other gambits which are more likely to get through to you, most of which are open to being misconstrued by nervous candidates.

An example of this is the external who offers you a couple of sheets of A4 listing the typos they've found. This is easily misconstrued as petty nitpicking. Not so. It's actually a graceful courtesy. For one thing, it shows that the examiner has paid you the compliment of bothering to read every page in such detail that they've found the typo on page 174 which your spell-checker missed. For another thing, it is much preferable to have that list beside you when you fix the typos, rather than being told that there are numerous typos which need to be fixed, but not being told where they are.

Another opening gambit which is widely used is to say something about your thesis along the lines of how interesting or readable it was. This gambit can actually mean several very different things. For some academics, 'readable' is a low-grade insult, referring to the sort of thing written by scientists who popularise science (an activity viewed with condescension by many academic researchers). For others, 'readable' is a compliment, meaning that it's interesting in a good way, unlike most of the turgid grot perpetrated by people writing in your area. How can you tell which meaning you are encountering? One indicator is the reputation of the examiner. If they're notoriously sadistic, then you're probably about to encounter trouble, so don't let that opening sentence lull you off your guard. If the examiner is known as a considerate soul, then you're probably being given a gentle start to the session. However, it's worth remembering that even the most considerate examiner is also a professional academic and likely to take the viva pretty seriously, so don't presume too much. If you encounter this gambit, a fairly safe response is a dry smile and a 'thank you' in a polite tone which implies that you're no idiot.

A third opening gambit which can be misconstrued is asking you to give a brief overview of your thesis. One understandable response to this is anger: surely, if the examiners have read your thesis properly, they shouldn't need a brief overview of it? Again, not so. The brief overview is a pretty good way of getting a nervous candidate to open up: they usually become so absorbed in the topic that they forget their nerves. It's also a good way of finding out which aspects of the thesis they find most important, which reveals a lot about their professionalism. In some cases, it's also useful for finding out just what the thesis is supposed to be about, if it's been written in a particularly vague or unreadable style. Quite often, a thesis will contain stuff which looks promising but which is poorly structured and badly described. If the content is good, then a few skilful changes can make a surprising difference to the thesis; if the content is as bad as the style, then the whole thing needs to be consigned to a nameless pit and erased from human memory. Either way, this opening gambit helps the examiners towards a decision.

It's tempting at this stage to break the third golden rule, by panicking and blurting out the truth about things you did wrong. Don't give in to temptation. Instead, give a clear, previously prepared overview, listing the main findings

and the main ways in which this work is a contribution to knowledge. You might want to use a few gambits of your own to show that you know the rules of the game – for instance, a discreet reference to your latest paper in a major journal, or a mention of ongoing work with a major figure in the field. Don't overdo it, though – remember that you're a candidate, not an examiner.

The mid-game

After the opening exchanges the real business begins, and vivas begin to differ. As noted above, examiners have four main options available to them in terms of outcomes: straight pass, pass subject to minor changes, pass subject to major changes and fail. (They can also award an MPhil, instead of a PhD.) They have many more options available to them in terms of how they conduct the viva itself, and it's important to remember that a viva can feel like a grim interrogation to you, but end up with a straight pass.

The straight pass

At one end of the cosiness scale is the situation where the examiners make it clear from the outset that there's little doubt this will be a straight pass, and then ask a few questions for courtesy's sake before heading off with you and your supervisor to lunch/coffee. You may be asked to fix three or four typos, for form's sake. This outcome typically occurs when you have a good supervisor, when you and your supervisor both know how the game is played, and when you've done a thoroughly good job on your dissertation.

Minor changes

Next down the scale is the viva where you are asked a few technical questions to check on specific points. You probably won't be able to answer all the questions either to your satisfaction or to theirs. Don't let that shake you: nobody can answer all the possible sensible questions, or have done all the relevant reading. An example of this is as follows. You have done a PhD which involves a new taxonomy of human error types. You have done the essential reading (Reason, Hollnagel, Rasmussen, and so on). You have also done some good further reading by looking at the literature on formal taxonomic classification in biology. The external examiner asks you whether you have read the literature on use of multidimensional statistics for classification. You haven't. What do you do? Well, for a start, you don't panic. Although the question is a valid one, you have already gone beyond standard best practice in your area by bothering to read up on formal taxonomy. The leading literature on human error isn't based on multidimensional stats and cluster algorithms. Although you could in principle have investigated that route, it's only one of many routes which you could have taken, and it's physically impossible to take all of them. Saying that you could have taken it is very different from saying that you should have taken it. So, you can bounce the question back at the external by

making some of the points above, and politely asking what they think the multidimensional approach would offer to this area. You can then get into a debate with them which allows you to demonstrate your ability, which is the main point. To conclude this example, if you make a good case in the debate, you may be asked to add a sentence saying that you chose not to use multidimensional stats, and giving the reason for not using them: a pretty minor change.

Major changes

A more serious situation would be where the examiner's question identifies a serious area of ignorance on your part. A good example of this comes from statistics. Suppose you have looked at different groups' perceptions of how car crashes are shown in the popular media, and have gathered some numeric data on the respondents' perceptions. You write this up in neat tables and mention in your discussion that the difference between two groups is significant, and that another finding is highly significant. The examiners reach this point in your thesis and the external examiner says that you have described results as significant and as highly significant, but haven't mentioned the tests you used or the p values involved.

None of the options at this point are good. The least bad is that you tell them which tests you used and what the p values were; the examiners will wonder silently what sort of idiot you were to omit this information and will be on the lookout for further signs of idiocy, but you may well get away with simply adding the missing information. The two other main options are about as bad as each other. One is that you tell them that you use only qualitative methods and don't agree with quantitative methods on principle; you then look like an idiot for choosing a non-qualitative external examiner, and for having gathered quantitative data but not analysed it quantitatively. This issue relates to some serious debates about which skills in a discipline are essential rather than optional, which go beyond the scope of this book: to use an extreme (and genuine) example, should someone be allowed to graduate in French if they refuse on ideological grounds to use standard French spelling and punctuation? If you don't approve of cabinets, that's fair enough, but to undertake an apprenticeship in cabinet-making when you feel that way is a decision that falls somewhat short of being sensible.

The last main option involves your admitting that you have never heard of statistical tests or p values, and asking what p values have to do with significance anyway. This approach might be acceptable in some disciplines, but in others where statistics form a core skill (e.g. experimental psychology) it would be disastrous. If you've ended up in a situation where your external is asking this sort of question and where your answer is an admission of total ignorance, then you've made a serious mistake in your choice of external, in your choice of discipline, or in your approach to your subject. The best that you can hope for with either of the two latter options is some serious revisions. Even if you wriggle out of this particular question, the session will have shifted from a fairly routine check to a serious investigation of whether or not you

deserve to pass, and there's a strong likelihood that one of the next questions will sink you fair and square.

The fail

At the bottom of the cosiness scale is the viva where the examiners think that you've made a serious mess of things, and where you exacerbate matters by being gratuitously offensive, ignorant and/or stupid. Usually, but not invariably, these cases occur when the student submits their thesis against the advice of the supervisor. A typical example might be a part-time PhD student who has a fairly influential day job as a manager, and who cobbles together a dissertation topic on job satisfaction based on reading textbooks and professional magazines, then goes on to conduct a badly designed questionnaire and/or some badly designed interviews, and who talks about 'getting all this airy-fairy academic stuff out of the way'. (Yes, this sort of thing has really happened, and more than once.) There isn't much that can be salvaged from such cases. The literature review is too simplistic to lead to an interesting research question; the methods are too boring to form the basis of a decent rewrite; the data will probably be untrustworthy or uninformative because of the flaws in the methods. Work of this sort will fail, and deservedly so. Again, if you think that cabinet-making is overrated and that flatpack furniture is just as good, then you're entitled to that opinion, but you would be pretty silly to apply for an examination as a would-be master cabinet-maker and bring along a poorly assembled flatpack as your alleged master piece.

The end game

By the end of the session, the examiners will probably have reached a conclusion about what to do with you. 'Probably' because they will need to check with each other and reach an agreed verdict. They will politely ask you to leave, and will do whatever examiners do while you're pacing around in the corridor, feeling nervous.

What examiners do is to check with each other, reach an agreed verdict and have some breathing space. If your thesis is a clear pass or a clear fail, then they will check explicitly that they all agree. If it's a clear pass, they won't necessarily summon you back 30 seconds after you've gone out; quite a lot of examiners believe in keeping the candidate waiting for a few minutes, on the grounds that it's good for the candidate's soul.

If there's consensus that you'll have to make changes, then nice examiners will draw up a clear list. This might be a list written there and then, or it might be emailed to you a day or two later.

If there is no consensus, then the examiners have to slug it out among themselves. At this point you can reap what you have sown much earlier. For example, if you have produced a couple of decent journal papers out of your work, then that demonstrates that your work is of adequate professional quality, which strengthens the case for anyone wishing to argue that your thesis is basically

passable, even if it's been badly written up. Similarly, if you have done a solid literature review, then that shows that you have a proper professional knowledge of your area, even if your data collection was a bit tatty. Both of these examples involve starting early; they're not something you can cobble together in the last week. It's a good idea, a year or so into your PhD, to read your institution's regulations and then get someone knowledgeable to translate them into English for you, so that you can find out about things like indications of acceptable quality in the thesis. If there's something about 'publishable in a peer-reviewed journal', for instance, then getting a couple of publications in a peer-reviewed journal will help your case in the event of a debatable verdict after the viva.

When all of this has been done, the examiners will reach an agreement with your supervisor about the next stages, and summon you back. Some will say the magic words: 'Congratulations, Dr Smith'; others won't. Strictly speaking, you aren't Dr Smith until you've formally graduated, so don't read anything too much into it if they don't use those words; externals are the sort of people who will probably know about such distinctions and who may phrase their greeting accordingly. The rest of the session will quite probably be a bit hazy. If you and/or your friends have been efficient, there may be celebrations ready. The examiners may or may not participate in the festivities; the day will end, and in the fullness of time the first day of the rest of your life will dawn.

So, that's what happens from the examiners' point of view. What happens from your point of view? This section is briefer, partly because much of it is covered above and partly because it's also covered in depth in all the other books on this topic.

Preparing yourself

Obviously, the best preparation for a viva is an excellent dissertation. Early in your PhD, discuss with your supervisor whether or not to go for a journal publication or two. Supervisors, and disciplines, vary in this regard. When you write up, allow plenty of time to do a decent job, and pay particular attention to displaying your cabinet-making skills in the thesis. Choose an appropriate external: by this stage in your career you should have a reasonable idea of the relevant rules of the game and of the main relevant players.

The week before

In the week before the viva, re-read your thesis and your data, plus some of the key literature. You'll probably be utterly sick of all of them long before this stage, so reward yourself with chocolate, or whatever works for you. Organise a mock viva, including a presentation, with at least one mock examiner who knows the craft skills of doing a good viva and presentation. If they're good, they won't be gentle with you in the mock viva, and they will give you constructive feedback about what to change for the real event. A lot of this is likely to

involve blood in the water – you'll probably panic gently in the mock session and blurt out needless admissions of weakness such as: 'I know now that I should have used a larger sample size', rather than something like 'My next study will extend this and will use a larger sample.'

After this:

- Do whatever is needed in light of the mock viva
- Go through the 'generic viva questions' (at the end of this chapter) and think up answers
- Make a list of the questions that frighten you most and compose answers to them
- Skim through a couple of papers by your examiners, noting their topic area, approach and style
- Prepare a publication plan for the material in your dissertation (which material, parcelled how, for which venue) in case the examiners ask about this.

The day before

The day before the viva, check that you are sure where and when the session will take place (there may have been a last-minute change which you missed). Line up a trusted friend to be available for you during the viva day; even a pass with minor changes can leave some candidates feeling like a thoroughly wrung dishcloth. Check that you know the examiners' names, titles and main publications. This is not to help you grovel; it is to show professional courtesy and to improve your chances of anticipating the direction of their questions. Make sure that you have appropriate clean clothing for the day and a hard copy of your thesis. Ask your supervisor politely if they will make sure they have a copy of any required changes, in case you forget in the excitement of the moment. (They will probably be planning to do this anyway, but it doesn't hurt to make doubly sure.)

- Mark up your dissertation. Put tabs (Post-it notes or similar) on the pages you're most likely to want to refer to
- Decide if there's any supporting documentation (e.g. key papers, design notes, data examples) not included in your dissertation that you want to have along. You'll almost certainly never refer to any of it, but it might make you feel safer
- Skim through your five key references. If you don't already have adequate notes in your annotated bibliography, then make notes on the key papers: what they did, why they are important, how your work relates to them, implications they have for your work. Be able to refer to the papers by the names of their authors
- Having done your preparation in good time, do something utterly relaxing and diverting the day before: sports, a walk, your favourite classic film, whatever. Do not try drinking binges, extreme sports or anything else which might leave you feeling bad the next day
- Get a good night's sleep.

On the day

On the day, turn up in plenty of time, and have something to do while you wait. Don't be offended if you aren't introduced to the examiners or invited to join them for lunch, or if you're kept waiting before the session begins. All of these are perfectly routine features of the viva process, usually for practical reasons. You might, for instance, be kept waiting because some idiot has been illicitly using the viva room for an unofficial seminar, and has had to be thrown out, leaving the examiners with the thrilling job of rearranging all the furniture.

At the start of the viva, be polite and do your exercises for staying calm if you need to. If you aren't asked to do a presentation or an overview, don't fret: the mock session won't have been wasted, because it will have helped you to pull together your thoughts about the thesis in a way which will come in very useful during the viva.

The first question or two will probably be fairly light, and used for breaking the ice. With these and the subsequent questions, you need to remember the three golden rules (don't lie, don't try to be funny and don't panic and blurt out the truth) plus a couple of other things.

One is that the viva is like fencing practice. The session is used to assess your fencing skills, so you are expected to defend yourself in a way which shows your skill in fencing. You are neither expected to let your opponent hit you every time, nor to attempt to kick your opponent in the groin and then pummel them to death. What matters is how you answer the questions, rather than whether you happen to know a correct answer. At this level, there often aren't any unambiguously correct answers.

Another thing to remember is that you don't need to reply instantly. You can buy yourself some thinking time by using tactics such as raising an eyebrow, saying 'Hmmm' in a thoughtful way, or saying: 'That's an interesting question; I'll need to think about that for a moment.' There's also nothing wrong with asking the examiner to clarify something in the question (as long as you don't ask something silly, like the meaning of a term which is a central part of your discipline). When you've given your answer, there's nothing wrong with checking whether it's answering the question they intended.

One colleague scores vivas like a boxing match: for each question and response, he decides if the point goes to the student or the examiner. The point of the analogy is that, barring a rare knock-out blow (usually self-inflicted, such as a student admitting plagiarism, or blurting out by way of explanation, 'My supervisor made me do it!'), you 'win on points'. It doesn't matter if the examiners get in a few punches, as long as you get in more.

After the viva

After the viva, make sure that you don't vanish off the face of the earth; it's a good idea to borrow a friend's office to retire to, but a bad idea not to let anyone know that you're in there, so that the examiners have to scour the corridors looking for you. If you've failed, take the news calmly, be polite and read our section on what to do if things go wrong after giving a presentation (see p. 176)

(in brief, go away and feel sorry for yourself for the rest of the day, then do some sensible advice-gathering and planning the next day – a fail is not the end of the world). Statistically speaking, though, you will probably be passed subject to some changes to the thesis. There is no point in arguing about the changes at this stage – argument would only show that you don't understand the way things work on a PhD. Instead, be grateful that you've passed subject to changes, thank the examiners and your supervisor politely and go off to celebrate or collapse in an exhausted heap. If you've passed without changes, then be sure to thank your supervisor – who will have earned it. You can now go out for whatever form of celebration takes your fancy.

Many students are so overwhelmed by the viva that the full impact does not sink in for some time. One of our students had the following experience. The examiners began the viva with: 'Congratulations, Dr X'. She missed that. They asked interested questions for three hours, and then recommended pass with revisions. She missed that. En route to the department celebration, she stopped her supervisor and asked: 'What just happened?' Her supervisor reassured her: 'You passed.' She paused again: 'Are you sure?'

Handling revisions

The day after the viva, you need to present yourself at your supervisor's door and work out precisely what needs to be done and by when. A surprising proportion of candidates give up at this stage. Doing corrections is not much fun, but it's a lot better than failing. Work out a clear timetable, with some contingency time, and get cracking on the corrections. If you want to have a break first, that's up to you, but don't put the corrections off; do them at the earliest possible opportunity and make sure your supervisor okays them. Write a covering letter detailing where you have made which changes and how – that makes it a lot easier for the examiners to check that you have done everything required. It's useful to present the changes in a table: the first column lists the revisions required by the examiners, in their language, one change per row; the second column details the action you've taken (including page numbers) or explains why you've taken an alternative course. In most institutions, minor changes will only need to go back to the main examiner, but major changes will need to be approved by the whole examination team, and a covering letter makes life easier for everyone involved in such situations.

During or after the viva, you need to get the examiners to be very specific about the changes they want. Which chapter, which section of the chapter, which paragraph in the section need to be changed? Can they give you an example of the change they mean? How is this different from what was addressed in section X of the dissertation? You need to show judgement and discretion – if they say something like 'This whole chapter is unclear', then there's a limit to how much precision anyone can give.

You also need to check that you know the date by which the corrections are due. Do not aim to have everything ready five minutes before the deadline; you

will need to liaise with your supervisor about the revisions and give your supervisor a reasonable amount of time to check them before you hand them in. This is particularly important if you're near the end of your time as a registered PhD student. The last thing you want to do is to miss the deadline for the revisions because (a) your printer broke down at the last minute or (b) your supervisor spotted a fatal flaw requiring days of work on your revisions when you finally handed them over for inspection the day before the deadline.

Doing the revisions can produce surprising feelings of revulsion for some students – it's a bit like washing up greasy plates in cold water the morning after a wild party when you have a massive hangover, or so we are reliably informed by friends who attend wild parties. It's worth knowing about this so that if you find yourself engaged in displacement activities rather than doing the corrections, then you can spot it and do something about it. The standard motivation techniques, plus strong support from friends, are helpful here.

Once the changes have been approved, you can plan for graduation. Most institutions allow you to have two guests at the ceremony, which normally means that the candidate's partner and one parent attend while the other parent remains in outer darkness – a source of potential annoyance, and one which it's wise to address as early as possible. Many candidates end up wishing they had better photos of themselves in the formal gowns; it's worth thinking about hiring the gown for a week instead of just a day, and then arranging some decent photos somewhere scenic (especially if you graduate in winter and it's pouring with rain outside on the day of the ceremony).

After all of this, you will probably never want to see your thesis again, and will be seriously tempted to burn it to ashes. Don't do that. The thesis is like a mask: where you see only the inside with all its imperfections, the rest of the world sees the glittering, burnished exterior. Yes, that's a somewhat over the top metaphor, but you've earned a bit of praise by the time you reach this stage.

The viva: hints, lists and things to remember

Despite the reputation of the viva, the truth is that, by the time you get there, you've already done the hard part. Remember: a viva is pass–fail. Most examiners are looking for a reason to pass the candidate. Your job is to make it easy for them. Perfection is not required. Competence is.

Personal presentation for the viva

Dressing for the viva is a form of expressive behaviour: the manner of dress indicates the candidate's role and attitudes. Therefore, candidates should dress in a way that shows respect for the examiners and for the gravity of the process. This means a degree of formality. A simple rule of thumb is to dress as one would for a professional job interview.

Flippancy in dress implies flippancy about the examination. The student in torn jeans and a dirty flannel shirt is conveying, 'I can't be bothered'. One should also avoid gaffes that are likely to distract the examiners from your erudite and scintillating responses.

How to distract or annoy your examiners (examples from life)

- **Smell:** people tend to perspire when they are nervous. Sitting in an enclosed space for two or more hours with someone else's body odour is not particularly pleasant. So do take care over hygiene on the morning of your viva, and use an effective deodorant. Strong perfumes can be as distracting as body odour, so avoid those as well
- **Wear something uncomfortable:** 'a degree of formality' need not mean a business suit and tie, especially if you never wear that sort of thing and it makes you uncomfortable. Watching a student tug nervously at jacket sleeves, or pluck at pockets on a jacket so new that the pockets are still tacked shut, can be most distracting – both to the student and to the examiners. If you mean to wear a tie (or any unfamiliar garment), then wear it repeatedly over a couple of weeks before the viva in order to habituate to it
- **Wear something sexy:** tight T-shirts over bulging muscles, plunging necklines and short skirts belong in pubs and parties, not PhD vivas
- **Forget the tissues:** It's painful to everyone when the student has an incorrigible sniffle and no means to address it. Bring tissues and cough lozenges (the examiners should ensure that water is provided for you). Tissues are also useful when you spill your water into your lap. Useful, too, for wiping the sweat from your brow should nervous perspiration break out on your face
- **Wear squeaky shoes:** squeaky shoes are like a persistent bad joke. One of us sat through a viva in which the student shuffled his feet under the table whenever he was thinking or nervous. The chirps, creaks and groans that came from his shoes were hilarious, functioning as an anxiety meter. The examiners struggled to suppress their laughter.

Presentation is something you want to sort out in advance, so that you can forget about it on the day. Good presentation gives the student confidence and sends the right signals to the examiners.

And don't forget your beauty sleep – a good night's sleep before a viva is disproportionately beneficial.

How to fail a viva

- Assume that the viva doesn't matter
- Answer any question about what you did with, 'My supervisor made me do it'
- Stick to one-word answers
- Display intransigence

- Display rampant cynicism
- Display flippancy
- Display a lack of interest
- Persist in an inability to describe your own work
- Persist in an inability to define fundamental terms
- Persist in an inability to talk about the papers you cite
- Call the examiner rude names.

These are tried and true methods; we've seen students fail using them.

Also, don't waste time second-guessing the examiners. A professor in our acquaintance tells the story of a brilliant student who, having seen the professor write 'failure' in his notes, decided that failure was imminent and 'died' through the latter half of her viva. The professor couldn't understand the dramatic change in her previously flawless performance and asked about it afterwards. When she explained, he was horrified; he'd actually just been making a note to follow up on an interesting idea (about failure) in one of her answers.

How to impress your examiners

- Come prepared
- Listen; comprehend the questions and address them directly
- Make eye contact
- Show enthusiasm for your work
- See your work in the bigger picture
- Be able to refer directly to your text (highlight key passages) in answering questions
- Be able to refer directly to seminal texts by author and with accuracy
- Be able to articulate the nature and scale of your contribution
- Think forward – think beyond the research to further work and implications
- Be reflective – be able to articulate both what was good about your work and what could be improved, and how.

These are tried and true methods. Students who show command of their material – both their own research and the prior work that frames and contributes to it – and who engage in the examination dialogue with knowledge, interest and courtesy are able to impress their examiners, even though they may also make some errors or sometimes answer falteringly. Examiners like lively and interesting examinations.

Fending off panic

- Pause: you're allowed time to think
- Breathe deeply: three deep, 'centring' breaths, making sure that you exhale slowly, usually help

- Take a drink: there's usually water on the table
- Make quick notes to yourself, especially if you have more than one point to make.

If you don't understand the question or don't know the answer:

- Ask the examiner to repeat the question (chances are, the examiner will simplify it on repetition). This is best when you simply didn't take the question in
- Rephrase the question back to the examiner: 'I think you're asking me about X' – and then answer it
- Offer alternative interpretations: 'I'm not sure if you mean X or Y. Could you clarify?'
- It's much better to offer an interpretation of the question than to say 'I don't understand', but once or twice you can do that too.

Keep it simple. When you hear yourself saying the same thing for the third time, just *stop and smile*, or say, 'Sorry, I'm repeating myself.' We all get nervous. Once (but preferably only once) in a viva, if you really can't help yourself, you're allowed to relax the stiff upper lip entirely and say something like, 'I'm sorry, I'm feeling very nervous, I just need a moment . . .' The examiners are likely to back off a bit and ask you a warm-up question before carrying on in earnest.

Questions examiners ask

- **Warm-up questions** to calm you down. Often of the form, 'So how did you come to research this subject?' Or, 'Can you summarise your core thesis for us?'
- **Confirmatory questions** to let you demonstrate your knowledge. Often in the form of asking you to reiterate or define something in your dissertation
- **Deep confirmatory questions** to let you demonstrate that your knowledge is more than skin deep. These are usually follow-ups to confirmatory questions that take up some point in your answer. Just keep your head and continue to address the questions
- **Calibration questions** to help the examiner check their own understanding of your work
- **Scholarship questions** to let you demonstrate that you know the field as well as your own research
- **Salvaging questions** – when you've written something badly, to let you show you do know what you're talking about after all
- **Pushing the envelope questions** to see how far your knowledge goes
- **'This is neat' questions** to give the examiner a chance to discuss your interesting ideas
- **Redemptive, 'lesson learned' questions** to give you a chance to admit some awful blunder in your work so that the examiner can 'let you off' without

worrying that you'll make it again. A typical example is, 'Would you take this approach again if you were pursuing this issue?' when a student has applied an inappropriate method that yielded little

- **'This is a good student; how good?' questions** – a little 'sparring' to let you really show your stuff
- **'Give me a reason to pass you' questions** – often, if the examiners continue asking about the same topic, it's because they're interested; if so, then cooperate actively with them, rather than trying to change the topic.

These are all moderately benign questions. If you arouse the examiners' anger or a suspicion that there is something wrong with your work, however, you may be asked some hard, sharp questions. The next section lists some classic 'killer' questions and suggests some ways of responding effectively to them.

Killer questions and how to survive them

In this section, Q = question, A = suggested answer, C = our comments on the question and/or answer.

***Q*:** How does your work relate to Jim Bloggs' recent paper? (when you've never heard of Bloggs)
***A*:** 'I'm not familiar with that paper. Does he take an X approach or a Y approach?'
***C*:** Show something you do know that's relevant; then, when the examiner offers a *précis:* 'Ah, so it's like so-and-so's work?'

***Q*:** Isn't this obvious?
***A*:** 'Well, it may appear that way with hindsight, but there was surprisingly little work on this topic in the literature, and the question needed to be properly answered.'
***C*:** Many dissertations codify what people think they already know but which has never been properly established. 'Obvious' can be good; it can make a contribution. Marian's *internal* examiner asked her if her thesis was obvious, and, fortunately, her *external* examiner intervened by asking if it was only obvious because he'd read her dissertation. You might try a modestly phrased version of this answer yourself if nobody offers it for you.

***Q*:** Isn't this just like Brown's work?
***A*:** 'It differs from Brown's work because . . .'
***C*:** Everyone worries that someone else is going to 'gazump' them and publish exactly their work just before they do. Forget it. There will be something – a difference of approach, of technique, of sample – that distinguishes your work and protects your contribution. If you know Brown's work already, then you should have already identified how it differs from yours; if you don't, ask about Brown's work until the answers reveal a difference.

***Q*:** You use the term X in two different ways in Chapters 4 and 6. What do you mean?
***A*:** 'In Chapter 4, I was using Smith's definition, which was most appropriate for that part of the thesis. In Chapter 6, I was using Brown's . . .'
***C*:** Answer the question, giving a concise clarification. Make a note of what you say because you'll probably be asked to amend the text with the clarification when you do your corrections.

***Q*:** Why didn't you . . .?
***A*:** 'Because . . .'
***C*:** This is why you re-read your thesis and have a mock viva. Re-reading your thesis will remind you of why you did things the way you did (and, conversely, tell you why you didn't use the other options). This will also give a sanity check that you haven't missed anything obvious. If the suggestion is something little known in your field, then you can reply along the lines of, 'That's interesting, and it sounds as if it should be more widely known in this field.' You can then turn this into a discussion of methods in the field and an opportunity to talk about the things you *do* know about.

Some ways of addressing weakness

Sometimes, you just have to admit that you were wrong. Occasionally, just making the admission with humour is effective. (As with the student who, when asked if she would use the same (fruitless) survey technique again, said with feeling: 'Hell, no'.)

More often, it's safer to follow the three-point plan:

1 Reiterate why whatever you did was a justified choice at the outset
2 Explain, as simply as possible and without apology, that you understand why it failed
3 Make some alternative suggestions about what you'd do instead next time that would improve your chances of getting it right.

No one expects doctoral research to flow smoothly without errors or hitches. Indeed, it is rare for any research to do so – research is opportunistic and (happily) full of surprises. What examiners expect is that students will respond to the errors and hitches with intelligence and by learning from them.

Table 15.1 Generic viva questions

We haven't suggested answers to these, for obvious reasons. You may find it reassuring and useful to have a friend ask you these, and then see if you can answer them. The friend doesn't need to understand your answer; if you can answer swiftly, confidently and concisely, then you'll probably be fine. If you can't, then some time thinking about possible answers should prove very useful.

- How did you come to research this topic in this manner?
- What are the main achievements of your research?
- Which of the achievements is most important to you, and why?
- What has your thesis contributed to our knowledge in this field?
- What are the major theoretical strands in this area: what are the crucial ideas and who are the main contributors?
- What are the main issues (matters of debate or dispute) in this area?
- Where is your thesis 'placed' in terms of the existing theory and debate? How would the major researchers react to your ideas?
- Who, in your opinion, will be most interested in this work?
- What published research is closest to your work? Who are your main competitors, and how is your research distinguished from theirs?
- Why did you choose the particular research methodology that you used?
- Did you consider using any other research methodology?
- What were the crucial research decisions that you made?
- If you were doing this research again, what would you do differently?
- What do you see as the next steps in this research?
- What was the most interesting finding in your results?
- Isn't this all obvious?
- Were you surprised by any of your results (if so, why, and what was surprising)?
- What advice would you give a new student entering this area?
- What is your plan for publication?
- What haven't I asked you that I should have done, and what would your answer have been?

Chapter 16

Sabotage and salvation

Or, developing habits for success

• Reputations • Destructive habits • Time, sensible planning and useful displacement activities • Constructive habits • Professional etiquette: respecting working relationships

So, we've established that there are lots of ways to climb a mountain. There are also lots of ways to fall off the mountain if you're not paying attention. Which outcome you get depends largely on how you manage yourself and your behaviour. Preventing a bad outcome is better than trying to cure one, and prevention is easier if you're brutally honest with yourself. This chapter is about self-management, about learning to recognise and avoid your bad habits, and about professional etiquette.

We start with a fundamental concept: reputation. Then we walk through three categories of behaviour: behavioural enemies (or self-destructive habits), displacement activities (or ways of doing something constructive while gaining some 'mental space'), and constructive habits and their relationship to professional etiquette.

Reputations

What sort of researcher and colleague do you want to be known as? Most people would prefer to be viewed as widely respected, fair, honest, brilliant, kind, supportive and things of that sort, and there are people in the research community who fit that description. Unfortunately, there are also those known as exclusive, back-stabbing, corrupt or self-serving.

Your reputation is shaped by your accomplishments, your behaviour and your interactions. Good research which is well published contributes to your reputation, as does a record of effective collaboration, generous and successful PhD supervision, and attracting grants which are then used for good research, well published. Those are the usual 'academic metrics'. Engagement in and contribution to the research community through things like programme committees for conferences, editorial boards for journals, policy consultations, external examination, refereeing, networking effectively, sharing information and mentoring also help. The positive side of a reputation within the research community is that it 'makes' your career.

The negative side of a reputation within the research community is that a bad reputation can destroy your career. It takes some time to build a sound reputation, but it only takes one or two unworthy acts to destroy one. The extreme case is academic fraud. The entire edifice of research is based on a foundation of basic starting points (data, methods, etc.) When you do some research, you start from what is already known in the field. If it turns out that one of those starting points is wrong because someone deliberately faked it, then the time you spent in your research was wasted. In some areas, such as medicine, delays in finding the answer can lead to people dying.

Such instances are extreme. More common instances involve grey areas – for instance, trying to claim more credit than is strictly justifiable, or making exaggerated claims. There are also personality issues, such as people who are needlessly aggressive or rude to colleagues. Although such bad habits can to some extent be outweighed by good-quality research, nobody actively wants to work with someone unpleasant and untrustworthy if there is an alternative. Such people tend to suffer passive damage to their careers, via things which do *not* happen, particularly where a career marker involves invitations – for instance, invitations to join editorial boards, to give keynote talks at conferences or to collaborate on major research proposals. An interesting feature of this is that the people involved may be quite unaware that it is happening.

You'll find that managing your behaviour has a lot to do with establishing your good reputation, and that reputation recurs through the discussion in this chapter.

Destructive habits

PhDs are messy, personal and ill-specified. They involve putting your ideas on the line in a way that is more personal than writing essays or papers at undergraduate or masters level, and many students perceive that it's not just their ideas that are being judged, but their intellect and by implication their worth. PhDs involve intimate, intense, long-term relationships with supervisors, often without much choice or planning. People tend to learn what a PhD is and entails implicitly; the rules and requirements aren't specified very clearly (hence the need for books like this). As a result, capable and accomplished students experience stress, behave emotionally and often irrationally, and

take things personally. Many develop destructive habits and thereby become their own worst enemy.

Learned helplessness

If you give animals electric shocks when they attempt to escape, in a situation where they can't escape, eventually they stop trying to escape, even when the situation changes and escape is possible. (Like Milgram's conformity experiment, the research behind this finding would probably not get past an ethics committee today, but is invaluable as an insight into apparently unlikely behaviour.)

PhD students are particularly prone to this feeling, and usually go through at least one phase of feeling that they are getting nowhere and that there is no point in keeping going. If this is an accurate description of how you're feeling, then pull yourself together long enough to eat some chocolate and acquire a self-help book (e.g. *Feel the Fear and Do It Anyway* by Susan Jeffers – see 'Some further reading'). Read the book, set yourself some manageable goals that are at least vaguely relevant, and talk things through with someone who can give you sensible, supportive advice. Also, get some exercise away from your usual haunts, to help acquire a sense of perspective.

One of the advantages of well-designed research is that you should know precisely what you're doing at each stage of the research, and what you will do in response to each eventuality that might come along. The bad news is that this might involve knowing in advance that you will go through a long phase of data-crunching; the good news is that if you know this, you should know precisely how to crunch the data and what to do with the results when you finally get them. If you don't know this in advance, then you need to rethink your research design.

Taking ages to get nowhere

There are several quite different reasons for taking ages to get (apparently) nowhere, with different implications.

Reason 1: you are taking ages to get nowhere because you don't have the faintest idea what you are doing and where you are going. If you suspect this is the case, draw a diagram. It consists of an arrow going into a box. The arrow is your research question, the box is the data collection and analysis. Now draw arrows emerging from the box, with each arrow representing a different logically possible outcome from the data collection and analysis. For instance, the outcomes may be 'A is greater than B', 'A is smaller than B' and 'A and B are the same size'. You should be able to list all the possible outcomes and explain why each one tells you something useful and significant. (You should also remember this exercise from the chapter on 'Research design'.) You should also know exactly what form your data will take and how you are going to analyse it, right down to the level of what tables you will use to show your results. (You should not, however, have more than a shrewd suspicion of which particular

answer you will find, otherwise the research is probably too trivial to bother with.) If you fail this test, then you're taking chances and may well end up getting nowhere. Redesigning your research is a good idea in such cases; it doesn't mean that you have to use quantitative methods or whatever your personal bugbear is, or that you have to abandon your area of research. It simply means that you have to revise your question so that it's guaranteed to reduce the problem space (i.e. eliminate a set of possibilities which had previously seemed plausible), rather than being a bet on a particular finding. Gambling with several years of your life is not usually a wise idea, and undertaking research only if you are sure that the results will confirm your initial beliefs is a very dodgy undertaking – what would you do if the data disagreed with your initial beliefs? Fiddle the data or face the prospect of changing your opinions?

Reason 2 (in no particular order): you are so familiar with your work that 'somewhere' looks like 'nowhere', and you're dismissive of your own progress. If you pass the diagram test and are more than a third of the way through your planned time, then this is likely to be the explanation. The 'second-year blues' are a fairly normal part of doing a PhD. Ask your supervisor (or another experienced academic) for a reality check.

Reason 3: you are kidding yourself by confusing 'displacement activity' with 'productive activity'. This involves doing something that looks like work that isn't in the critical path to completing your PhD, and doesn't contribute to something that is in the critical path, and doesn't even contribute to something that contributes to something that is in the critical path. As with any unproductive activity, the first, most important, response should be: stop. Stop the activity. Stop reinforcing the negative feelings. Then choose a constructive activity instead, like getting someone else to help you set out an action plan with clear steps and specified checkpoints.

Isolation

Isolation and perceived isolation are problems for many (if not most, if not all) students, and especially for part-time students. Sometimes there are real barriers to interaction that need to be addressed (such as communication outside office hours, physical isolation or a lack of local expertise in your topic). The chapter on 'Networks' should help. We also isolate ourselves unnecessarily. Sometimes we have false expectations about what productive activity looks like (see Reason 3 above) and want to live the fantasy of the lone scholar in the ivory tower, even though what's really needed is a good critical conversation with someone who makes it necessary to externalise our thinking. Sometimes we have false expectations about other people's availability and interest. It's frustrating to hear students say things like: 'I didn't want to disturb you, because I know how busy you are' when we actually could have used an hour's distraction and a cup of coffee. Sometimes we have false expectations about ourselves, such as 'I work better alone'. The evidence is clear that, even though students do need

time to work quietly by themselves, those who seek dialogue regularly (every week, if not every day), and engage in the community, succeed more reliably, more confidently and more promptly – because they're exposed to more learning opportunities, more perspectives, more scrutiny – and more feedback.

Other assorted bad habits

There are numerous other bad habits which afflict researchers, such as hiding from your supervisor (covered in the chapter on 'Supervision'), bad time management, failure to prioritise, procrastination and not bothering to become familiar with the tools of the trade. If you're to sort yourself out properly, you need to learn how to identify and correct bad habits. Most bad habits involve deceiving, kidding or obstructing yourself. You need to be brutally honest with yourself in diagnosing them. You need to stop the ones that are causing you harm, but that doesn't mean that you have to proceed to correcting all of them. Many habits, such as following an interest regardless of whether it looks like a good career move, are personal choices and you might decide that the positive side of the habit is well worth the price. Others, though, such as refusing to accept that you are wrong, are bad for you. You won't improve without change; you won't undergo change without pain. Learn to accept that pain as a friend and your life will be transformed.

If you are worried about the long-term consequences of close familiarity with pain, you might be reassured to learn that there are ways of tackling research which involve a minimum risk of having to admit that you are wrong. Phrasing the research question in such a way that you have not committed yourself to any of the possible outcomes is a good example of this: whatever happens (short of a total shambles) you will have proof of your brilliance in identifying the right question in the first place.

Time, sensible planning and useful displacement activities

Things take time. There are different sorts of time. One sort is elapsed time; another sort is task time. A lot of things take quite a short time for the action itself (task time) but involve a lot of waiting around (elapsed time). For instance, you're organising something with someone else by email. Writing the emails may only take a total of five minutes at the keyboard, but the elapsed time to make the arrangements totals up to several days because you're having to wait for them to find answers before they can reply. Anger won't help; sensible planning will help.

Sensible planning is a very different activity from two familiar enemies, namely unproductive displacement activities and the wrong sort of expressive behaviour (i.e. the sort used to say 'I'm busy' in place of actually doing anything useful). Sensible planning is often difficult when you're stressed out by life events and hassles. The best thing to do initially is to buy yourself some time, plan how to buy yourself some more time, and bootstrap up a bit at a time.

How do you do that? Ironically, a good start is via displacement activities – the useful sort that help you relax and 'regroup'.

One of us was once given some very wise advice by their supervisor, namely that if you are going to engage in a displacement activity, you should make sure that it's a useful one. Useful displacement activities are essential to good research, but by definition aren't directly visible in the immediate task. Examples include sorting and tidying, updating your records, and doing general background reading (as opposed to focused reading). You have to do these things some time, so you might as well do them as useful displacement activities.

A long soaky bath

Once a week, instead of slumping despondently in front of the television, run yourself a long, hot bath. Lie in the bath with a wet cloth over your face. This will calm you down. It will also lead surprisingly often to your seeing your situation in clearer perspective, and realising some better ways of handling things. The long, soaky bath is our proxy for the whole class of activities whose purpose is to empty the mind and relax the body.

Take a walk

If you're suffering from a destructive habit or a pattern of frustration, try going for a walk. It's good for you, it clears your head, and it helps you get a sense of perspective – and a better mindset.

Tidy and file

Most people don't tidy and file enough. Tidying and filing, as displacement activities, can be very soothing and can give you a feeling of control. They can remind you of papers, insights and ideas that you'd forgotten. They also make a practical difference – it's much easier to be efficient and to have some spare time if your tidying and filing are under control.

This applies to life debris as well as PhD material. Most of us have large amounts of clutter. Look through your belongings, get rid of the things that are neither useful, loved nor beautiful, and create some storage space and some 'swap space'. Swap space is another useful concept: it's space needed temporarily while you rearrange things. For instance, if you're tidying shelves, you'll need at least enough swap space for the contents of one shelf so that you can empty that shelf, clean it, and decide which contents to put where. Hardly anyone has enough swap space or storage space. Don't try to do all of this at once; have an evening per week or per month when you do a bit.

Read about something different from your PhD topic

This will help you to break out of the cycle of worry about your PhD, will help you to see things in perspective and will quite probably one day provide you with the key insight that changes your life.

General reading is highly advisable, since a lot of the best work comes from applying work from one area to another area. (One of us once supervised an undergraduate dissertation which took a nineteenth-century researcher's formalisms for describing the structure of Russian folk tales and applied them to the plots of computer games . . . excellent and highly entertaining work, with a lot of implications for the computer games industry, but not exactly the sort of thing which is likely to emerge from focused reading.) The trouble is that you can never tell in advance when something will be useful or where; the Russian folk tale idea derived from reading about the topic some 20 years previously. The good news is that when you do encounter a relevant area for this sort of cross-fertilisation, you can produce brilliant work for very little apparent effort.

Displacement activities can be useful or unproductive. It's not the activity itself that makes the difference, but what you use it for, and how you use it. Using displacement activity to mask that you're stuck or confused is destructive. Using it briefly to buy yourself some planning and relaxation time is useful. One way to work out which it is, is to consider how long you've been indulging in displacement activity, and how regularly. If you've done it briefly and moved on, you're probably fine. If you've been doing it for hours or days or it's becoming habitual, then you need to reassess, because you've probably been kidding yourself.

Constructive habits

It's easier to develop constructive habits if you understand fully that your PhD is not just your PhD, but also a socially embedded activity that reflects more widely: on your supervisor, your department, your institution. You're in a complex relationship with your supervisor that is expected to change over time. But, whereas you'll be growing and changing significantly during your studies, your supervisor will be growing and changing more subtly – and will be less focused on their development than you are on yours.

Doing a PhD requires a balance between independence and guidance. On the one hand, you're expected to produce original work that is your own. On the other, you're expected to be guided by and to learn from your supervisor. Missing the balance either way (by ignoring your supervisor and insisting on doing everything by yourself without benefit of the available wisdom, or by relying too heavily on your supervisor) is problematic. The complexity of balance trickles into other issues, like intellectual property: students own their own work, but they rarely work in strict isolation, and so their work is often not just their own. Moreover, students often do work associated with projects or in collaboration with other people. Understanding these forms of interdependence is crucial to maintaining professional etiquette – that is, maintaining proper behaviour for a professional researcher. Professional etiquette is, in effect, a means of managing and protecting your professional reputation.

Communicate

Talk about your research. Talking about it forces you to 'put it out there', to express your ideas (and hence help you think through them), to articulate your concerns or issues (and hence help you assess them pragmatically) and to get your thinking scrutinised (and hence either reassure you that you're making sense or alert you early about errors, gaps or misconceptions). Talking about expectations and assumptions gives you a chance to calibrate yourself with others in your community – and may give others a chance to share tips and tricks.

Don't just talk – listen. Listening to other people's research can help you develop your critical skills and give you insights into what works and doesn't. Other students may have solved problems you're facing or are about to face. Just listen with a mite of scepticism; remember that most students are feeling vulnerable, and that makes some of them exaggerate their accomplishments and play down their anxieties and obstacles.

Make mistakes

You need to recognise that you can make mistakes during your PhD studies. Indeed, if you're not making mistakes, then you're probably not trying hard enough, because you're working within your comfort zone. The point is not to avoid mistakes entirely, but to learn from the ones you do make.

Part of the reality of mistakes is handling criticism. We are reminded of one student who, whenever one of her ideas was challenged would counter: 'Why do you hate me?' The first rule of academic criticism is: don't take it personally. The second rule is: criticism is engagement. If supervisors or colleagues criticise your work, it suggests that they have engaged with it sufficiently to have an opinion. Appreciate the engagement and learn from the criticism. The third rule is: not all criticism requires a response. Assess the criticism. If you can learn from it, then use it. If it's ill-founded or unwarranted (and you're sure you're in a position to judge whether or not it is), then consider whether there is a problem with how you've tried to communicate your ideas. If you're convinced after due consideration that the criticism is inappropriate, then ignore it. The fourth rule is: give the sort of criticism you'd like to receive (clear, informative, well-founded, constructive).

Practise finesse

No one enjoys being criticised, pilloried or humiliated (whether or not it's warranted). Nevertheless, academia requires us to critique, challenge and oppose, and to do so articulately. The trick is to also do so with finesse, using non-aggressive forms of speech, so that the points are made and the insights are expressed without the recipient feeling assaulted personally. Often this is as simple as avoiding bald assertion or harsh statement. Ask a question, rather than make a statement. Ask for clarification, rather than making a challenge. This has the

advantage of saving you from your own unnoticed assumptions and misconceptions, as well as giving your correspondent some 'room to move'. Behaviour counsellors often espouse the value of 'I statements': expressing a conflict in terms of its effect on you, rather than as an accusation against another. 'I'm confused when you use familiar terms in unfamiliar ways, and it would be helpful if you would define your usage when you're appropriating a familiar word to a specific technical meaning.' Or 'I'm distracted when you call me by the wrong name; please call me [the right name].' Everyone makes mistakes, and gentle correction saves face.

Give credit

You never lose by giving credit. You often gain.

- Understand the scope of your research and contribution: modesty pays
- Be scrupulous about giving credit where credit is due (e.g. when you publish papers)
- Be accurate in your use of other people's material (ideas, direct references, quotations, etc.) and attribute them correctly.

Giving credit is instrumental in establishing your integrity, and expressive in showing your respect for others' contributions.

Keep an eye on the Big Picture

It's very easy to get bogged down in detail, or to become immersed in the task of the moment. Unfortunately, time is limited, so you need to use your time effectively. This means that you need a strategy, to keep your eye on the Big Picture that links your research question to your research plan and your intended destination (see Chapter 8). It means that you need to be able to 'see the wood from the trees' – and also to know which wood you're in, and why.

Once you have a Big Picture, you need to keep it in mind, or at least to revisit it regularly. Monitor your work in terms of its contribution to your Big Picture. What's in the critical path? What isn't? Prioritise. This will also help you to avoid over-commitment, as long as you're honest with yourself about your capacity.

Professional etiquette: respecting working relationships

The basics of professional etiquette are comparable to the cardinal rules about dealing with your supervisor (see Chapter 4): being honest, articulate, informative, respectful and responsible. They are about observing your 'duty of care' to those involved directly or indirectly in your research (including yourself). They are founded in low-level, everyday behaviour: doing what you promise (reliability),

delivering on time (punctuality) and leaving emotion to one side in intellectual discourse (objectivity). And they are anchored in the notion that you are not an island: you are part of a social system and are accountable for your decisions and actions.

One skill essential to developing effective working relationships that is often forgotten (especially by academics) is *listening*. Another is *tolerance*.

Scenarios

Here are some examples of 'sticky situations', drawn from life. Consider your reactions.

You are visiting a company which you hope will give you access to data for your research. They ask you to sign a non-disclosure agreement. What should you do?
Do you understand the implications of a non-disclosure agreement for your research? Are you empowered to sign such an agreement, or should you consult your supervisor or the contracts department of your university first?

There's a conference deadline on Monday. On Friday, you have a bright idea for a paper and you whip together a draft over the weekend. But you can't find your supervisor on Monday. What should you do?
What's the worst that could happen? Perhaps that you go ahead, with some half-baked paper that has to be withdrawn once your supervisor sees it, or – worse – gets accepted and published, establishing a history of shoddy work . . . This may entail more than annoying your supervisor; you may be breaching university regulations and hence subject to disciplinary action.

Another student complains to you about his supervisor, accusing him of gross misconduct. The student is a bit of a clown, and you're not sure how much is exaggeration. On the other hand, the story he's telling is compelling and quite serious. What should you do?
What don't you know? What are the costs – to you, to this student, to his supervisor, to other students, to the department – of doing nothing, or of taking action? What response is both responsible and discreet?

You've been following your supervisor's guidance on a line of research, conducting studies that he sets out and that you flesh out together. You propose to write the work up for publication, but the supervisor objects. What should you do?
What don't you know? What might your supervisor's reasons be for objecting? Would you rather assume that your supervisor is an obstructive idiot, or ask some gentle questions before you make a fool of yourself?

You did some work as part of a project, hence part of a collaboration. You want to take the work further, extending the ideas a bit into a new paper. What should you do?
Are there boundaries to collaboration? What would you want your collaborators to do if the positions were reversed?

There aren't cut-and-dried answers to these scenarios. Most of them depend on things that may not be immediately apparent, and so it's usually a good idea to consider what isn't expressed, or isn't evident that might have a bearing on what the situation really is or really means.

Common principles for professional etiquette

Three principles for protecting your reputation can be captured in terms of familiar sayings:

1 **The golden rule:** do unto others as you would have them do unto you. (In fact, you might interpret this within a double standard and judge your own behaviour by the highest standards, while maintaining tolerance for the shortcomings of others)
2 **Prevention is better than cure:** establishing appropriate and explicit expectations in research interactions usually prevents misunderstandings later
3 **What goes around, comes around:** when you enter a PhD programme, you're entering an established social network; researchers you meet in your and your supervisor's domain are likely to know your supervisor and each other. Conversations and actions do not occur in isolation from all that interconnection – what you say outside may well follow you home.

The good news is that there are huge advantages to behaving well, developing a reputation as a 'fair dealer' and interacting with others in your research community. What goes around, comes around: the good works that you do are likely to lead to positive responses such as shared information, useful invitations and happy collaborations.

Chapter 17

What next?

• Career goals • Academia or elsewhere? • Academic career types
• Various other things • Identifying opportunities • Writing a CV
• Applications and cover letters • Job interviews

So there you are, viva completed, corrections finished to everyone's satisfaction, and waiting for graduation day, without the thesis filling your life. At this point many students realise with growing unease that they haven't given much thought to what to do next with their lives. That's the subject of this chapter.

One issue is career structure within the academic world. We discuss this so that you can observe the lifestyle of people who have followed various career routes and then think about which of these routes, if any, might suit you. This should help you decide which jobs to apply for as your next step.

Once you know which job to apply for, you need to know how to handle job interviews – what to do before interviews and during them. Most people take the perfectly understandable view that this involves thinking about what they have to offer; we describe a better strategy. We've phrased this in terms of applying for a lectureship, to help your morale . . .

Career goals

To make sense of academic careers, you need to understand what motivates successful researchers. According to Indiana Jones, the answer is 'Fortune and glory'. That, however, is fiction. The reality is more subtle. Successful researchers are driven by a need for two or more of three things: status, power and satisfaction of their curiosity. (You'll notice that money is not among them. If you're in it for the money, you'll probably choose a more lucrative profession instead.)

Satisfaction of curiosity

Satisfaction of curiosity is an important theme in research – you can be paid (not well, but well enough) to be nosy. If you are shrewd, you can use this to get funding for things such as travel to exotic places to study the behaviour of holidaymakers on sunny beaches. Wise geologists are aware that some types of lava are only found in a few places, such as Hawaii. Researchers crop up in all sorts of unlikely-sounding places – for instance, digging holes through bits of frozen wasteland in the Arctic, sitting in the control tower of an airfield watching the air traffic controllers, and on patrol with the local police, to mention just a few examples. However, nobody will pay you for long if you just satisfy your curiosity and do nothing more; you also have to let the world know what you've found, which leads on to the other two goals.

Status

Status in the academic world is not quite like status outside it. The status that really matters to a researcher is status in the research community. Within each research field there are well-established conferences, journals, newsletters, etc. There is also a body of researchers working in that area, who form its research community. They will usually read the same journals as each other, attend the same conferences, and so on. Within each research community there is a fairly clear pecking order, from beginners that no one has heard of, through moderately well-known researchers to the major authorities whose names and work are known and revered by everyone in the area.

Status in the research community does not derive from the prestige of your institution, or the impressiveness of your title (though these can help). What matters is the quality of your work. If you're doing boring, routine work, then the research community will be utterly unimpressed by your being Professor of Impressively Hard Concepts and will simply think that you don't deserve that post. If you're doing work which produces interesting findings and opens up new research directions for your colleagues, then you will be taken seriously, even if you're a research assistant at Fenlands College. Some academics actually make a deliberate choice to work in little-known places, on the grounds that a high-profile successful academic in such a place is more likely to be allowed to get on with their work without being messed around by The System. Status of this sort is spread in various ways, but mainly through word of mouth and social networks. It is recognised at a formal level in various ways within the research community: for instance, being invited to give keynote talks at conferences, being appointed to journal editorships and positions on funding bodies (these are known in the trade as 'esteem indicators').

Power

Power is extremely useful. For most researchers, an initial attraction is being able to refuse to do things which are an annoying distraction. Contrary to what Theory X managers believe, most researchers, if left to their own devices,

would happily research for as many hours a day as they could manage. Having power allows researchers more time to get on with what they really enjoy, which is a seductive prospect.

Where does power come from? In the researcher's home institution, power does not come from status in the research community; it comes from the ability to influence things in a way which matters to the host institution. This may come from official roles – for instance, if you're on the funding panel for a major grant-giving body, then some parts of your institution won't want to antagonise you too much. Other parts of your institution, however, couldn't care less – for instance, the parts which are concerned only with teaching and to whom research funding bodies are of no interest whatsoever. For these and other reasons, therefore, a more potent source of power is money. If you bring large amounts of money into the institution, then you will be viewed as a valuable asset. The more money you bring in, the more valuable you will be, and the better your chances of being treated well. Money in the accounts today is visibly useful to an organisation in a way which the prospect of money tomorrow from a funding body is not.

So far, all well and good. However, what happens when you're bringing in lots of money and become locked in conflict with someone else in the institution who is bringing in even more money? The answer is that you will probably lose. On a more virtuous level, what happens if you realise that your work can make the world a better place, but there aren't enough hours in the day for you to do all the things that are needed? The answer to both these questions is 'more power'. However, that comes with a price; acquiring more power will need resources that you could have spent on something else. So, it's a wise idea to find your preferred point of trade-off between power and price of power, in terms of position on the academic job hierarchy. Happiness matters.

Academia or elsewhere?

This chapter has an academic focus, largely to keep things simple. But there is a much bigger world. Some of the most interesting research is done outside academia, where timeframes, resources, funding and priorities are structured around The Market or around social or political priorities, rather than around arcane systems of status and reputation. One of the big distinguishing questions is to do with autonomy: how important is it to you to set your own research agenda, to choose your own projects, to ask questions in ways that you design? A second is to do with outcomes: how important is it to you to publish, to have visible credit for your research contributions, or to see your ideas implemented in concrete and practical ways? A third is to do with resources: who controls the key resources you need to do your work (this is crucial in big equipment disciplines such as astrophysics), and what level of funding does your research require? Another is to do with communities: what sort of people excite you, and where do they work?

Sometimes it's not a strict choice: people can keep a foot in each camp, either working in industry and maintaining collaboration with academia, or vice versa. This is heavily dependent on the discipline and the organisations involved. And,

of course, it's usually easier for more senior researchers to structure their work in interesting ways. Some companies and public organisations encourage employees to take the initiative, to publish and to collaborate. Others see that as frivolous distraction from the real business. Others are neutral, tolerating such activity as long as it doesn't interfere with the 'real work' or the organisation's priorities. Some welcome initiative, innovation and discovery – but keep it strictly private, so that they can exploit the intellectual property. It's up to you to work out what sort of environment suits your needs.

Depending on your local discipline and local culture, stepping out of academia for a while can have a varying impact on your ability to step back in later. For example, in the UK in computing, time spent in industry is a decided advantage, providing real-world experience and industry contacts, and lending practical credibility. In other cases, time spent in industry is time not building an academic career and hence putting you at a disadvantage. Similarly, the worth of time in academia can be interpreted variably. In some cases it is a decided advantage, lending authority and credibility. In others, it is viewed as self-indulgent time away from 'the real world'. Find out what the case is in your context. And consider not just 'How can I get a job now?' but also 'Where do I want to be in 10 years or 20?'

Whether you choose academia or elsewhere, the basics of 'selling' yourself are the same: finding out about potential employers (both in terms of who has jobs and what sorts of employers you want to work for), and assessing the fit between what you want from a job, what you can actually offer and what they want from an employee.

Do your reconnaissance; it's dangerous to make choices without assessing accurately the 'lie of the land'. Different organisations operate in different ways, and you need to discover the structures, priorities and cultures of each. Unfounded assumptions are rife on both sides and lead to silly misunderstandings. For example, one of us was courted by a major American computer company, and went through two days of successive half-hour interviews, each of which started: 'This isn't quite like the ivory tower you're used to, we don't concentrate on one project at a time here' (one then had to explain that running a research centre was rather different from that fairy tale model of academic research).

Academic career types

In Heroic Times, the hero was traditionally offered a choice by Fate when at an impressionable age. The choice was between a short, brilliant life and a long, unremarkable one. The legends which survived were invariably the ones where the hero chose the short, brilliant life. This may be because heroes were all predictable when it came to that choice, or perhaps it's simply that legends about people leading long, unremarkable lives did not have a great deal of staying power.

Anyway, the relevance of this to the would-be researcher is that there is a similar choice in academia. At a certain point in your career you have to make a decision. It's not quite the same as for heroes, but it's similar. After being a lecturer long enough to notch up the appropriate points on your CV, you can either

take the route of becoming primarily a researcher or primarily an administrator and teacher. The former is usually the glamorous route; the latter is normally the route followed by invaluable people who hold institutions together, and who are usually overworked, badly treated and unappreciated until their stress rating reaches the point where they take early retirement. This is not particularly fair, and we do not greatly approve of it. One crumb of consolation for those who take the worthy, unglamorous road is that they might some day become a head of department, perhaps a dean, maybe even a vice-chancellor, and have the prospect of wielding a fair quantity of legitimate power over those who took the other road. A nasty chewy bit in that crumb of consolation, however, will be the discovery that eminent research professors with high-profile research groups can wield a large quantity of less officially recognised power, and can play dirty organisational politics just as well as anyone else. So it goes.

There are various classic career patterns for academic researchers. None is right or wrong *per se*, though each has its advantages and disadvantages.

The empire builder

One classic route is through the various formal levels of academic seniority towards a research empire of your own. You start off by doing a PhD, then work as a postdoctoral research assistant for a few years, get a lectureship and work at that level for a few years, get a few grants on which you're principal investigator, become a Reader for a couple of years and then get a chair (i.e. become a professor). In the process of becoming a professor, you will have built up the start of an empire (research assistants and PhD students of your own); after becoming a professor, you will build up a research group, perhaps a research centre with lecturers, research assistants and PhD students attached to it, possibly a research institute. You have gradually shifted the balance of your activity from researching to research entrepreneurship – that is, to directing and managing research. This will make you a considerable power broker in your department, since you will be bringing large amounts of prestige and money in, so a wise head of department will not antagonise you. Most people who follow this route will not want to be a head of department; it's too much hassle, with no research reward. They might possibly take on the role for a couple of years just so they have it on their CV (it can come in handy, and can also make the point to any subsequent head of department that there is someone else who is perfectly capable of running the place if the newcomer gets any silly ideas about throwing their weight about). There is much to be said for this route if you want to get things done, and to wield some power; the drawbacks are the politics and the administrative effort involved. If these are not for you, you might consider something less fraught, such as the wandering scholar route.

The wandering scholar

Wandering scholars may wander geographically, or in academic discipline, or both. This has a long and honourable history. In the Middle Ages, scholars would move from university to university around Europe (having Latin as a common

language made this considerably easier). During the Napoleonic Wars, it was considered completely unremarkable for eminent British scientists to give visiting lectures in France, even while the two countries were at war. This tradition is still very much alive, and good research groups are often populated by bright researchers from around the world. For practical reasons, people following this route usually don't build up substantial formal empires, though they may build up formidable reputations. A word of warning, though: it's easy to build up a formidable reputation if you wander about geographically, as long as you publish your work in respected venues within your chosen research area – the journals and conferences that everyone reads and attends. However, without substance, publications and critical mass, all you accumulate is stamps in your passport.

It's difficult to build up a formidable reputation if you wander about between research topics. It takes time to establish a reputation (a rule of thumb is three years from starting a piece of research to seeing it in print in a reasonable journal and even longer in a high-status journal); if you change fields frequently, then you won't be able to do this. One apparent exception to this generalisation occurs if you use your wandering between areas as a way of building up a substantial body of expertise in related areas, then settle down in one area and apply concepts from other areas. That can be extremely productive, but does have an initial cost attached.

The geographically wandering scholar approach is a good way of working with the brightest minds in your area (and building your own reputation, if you have something good to offer), as well as seeing the world. However, if you have commitments which make this route difficult, or you dislike travel, then you may wish to consider a non-wandering career, described here as the hermit scholar approach.

Hermit scholars

Hermit scholars are, in fact, usually not celibate and usually do not live a life of austere contemplation in caves, but the mediaeval metaphor was too tempting to abandon. The term is used here to describe someone who conducts their own research, without a formal research group around them in their base institution (although often with a substantial network of collaborations externally) and whose research remains within a single theme. This is a perfectly respectable route and has quite a few advantages to offer, if played correctly. It can also be quite as social as the other routes, because of the nature of fame in academia, described above. People working in this tradition are quite likely to collaborate with researchers from other institutions around the world, and can build up a formidable reputation because of their in-depth knowledge of their chosen area.

Various other things

The classic fast track for research involves something along the lines of a first at Cambridge, followed by a PhD with someone who has an outstanding reputation,

followed by some postdoctoral work somewhere prestigious, and then a progression along the lines described above. Someone following this track will usually become more and more specialised in one or at most two areas as they progress.

However, it's important to remember that this is just one route. Another important fast track route can be described as a delayed-action fast track. It involves becoming expert in one area, then transferring concepts from that area to solve problems in a new area (the classic example here is John Maynard Smith's importation of game theory into evolutionary ecology). It is also important to remember that the race is not always to the fast: research reputations are built on quality of research, not speed of promotion. Becoming a professor by the age of 40 is a sign of achievement, but is not much use to the world if you don't come up with any particularly interesting research after becoming a professor. It also won't cut much ice with the rest of the research community – it's the content of your research which matters to the research community, not how quickly you climbed up the slippery pole.

Identifying opportunities

'Chance favours the prepared mind': some of the best job opportunities come from unexpected places, and you need to be open to re-thinking your ideas about what the ideal job looks like. Good job hunters are proactive. Look in the obvious places: newspapers or trade publications (particularly the ones with issues or sections devoted to advertising academic posts; find out where your intended employers advertise); employment agencies, job sites online or headhunters (both face-to-face and online); personnel sites of individual institutions. Consult the career counsellors at your institution and get their help.

Also look in the less obvious places: mailing lists, bulletin boards, announcements of grants (suggesting who might soon be advertising for postdocs). If you can anticipate the conditions leading to job opportunities, you can investigate those, rather than waiting for jobs to be announced.

But the single best way of identifying opportunities is to network. Tell your network that you're looking for a job. Employers are happier to hire a 'known quantity' – including someone recommended by someone whose judgement they trust. Use your personal as well as your professional networks – you never know who knows whom, and who might just make a connection. Ask your mentors (e.g. your supervisor, an academic who has taken an interest in your career, a colleague in industry who has provided guidance) to compile a list of half a dozen or so names of people who might have jobs (or know someone who has jobs), and ask if you can use your mentor's name in introducing yourself. Write letters: 'Dear Prof Eminence, Dr Rising Star suggested that I write to you . . .' The reputation of the mentor will draw attention and add interest to your introduction. But do expect at least one of the recipients to get in touch with the mentor to ask questions.

Writing a CV

The main purpose of a CV is to get you 'across the threshold', typically to get you an interview. What story do you want to tell about yourself; what do you want to emphasise? The story will change with the purpose, and so the CV will change for each use as well. Think about CVs as 'effective or ineffective' rather than as 'good or bad'. Read other people's CVs and consider what they say to you about the person, and why. Key features of an effective CV are:

- Continuity
- Evidence of development and progression
- Consistency
- Accuracy
- Accessibility.

The private 'repository' CV versus the selective, purpose-written CV

A good strategy is to keep one, private, up-to-date 'repository' CV containing anything that might possibly be useful, from publications through to course attendance. Things like key projects, seminars in other institutions, doctoral events, consultancy work, refereeing, conference organisation, awards (including studentships) and so on, can be relevant, so keep track of them. (Remember those annual reports all through the PhD? – you can use them as a good opportunity to update your repository CV, or you can use your repository CV as a good source to complete the reports.)

Then make strategic selections from the collection to tailor a CV for a specific use. Use a structure that reflects the purpose (e.g. one that maps onto the job requirements).

CV design choices: write it to be read

Imagine that your CV is one of 50 – or 500 – submitted for a position. Most selection panels first skim-read CVs in order to identify those worthy of further scrutiny. *Write your CV to be skimmed.*

Interview panels are trying to divine what sort of candidate you are. They will read CVs strategically to glean particular sorts of information (e.g. specific skills, particular experiences, evidence of team work, evidence of individual initiative), to look for 'danger signs' (e.g. lots of chopping and changing, inconsistencies, significant omissions), to examine continuity and to look for indications of development or excellence. *Write your CV to be scrutinised in detail.*

When you design your CV, you make choices about selection of information, emphasis and style of presentation.

Selection

What you choose to include can give your interviewers something to ask about. But *anything* you include is open to discussion. Don't include things you'd

rather avoid discussing or that might be misunderstood. Think carefully about whether you really want to include personal information (e.g. marital status) or religious or political affiliations, and even consider what your hobbies say about you before you decide to include them. Sometimes this 'peripheral' information can make all the difference – either for or against you – so make sure that what's there is how you want to be seen. Also consider what your omissions may say about you, especially omissions that relate to the purpose for which you're preparing the CV.

Emphasis

Choices you make about things like how you record dates, how you describe previous jobs and how you report your education can convey what you think is important. For example, when you're listing your degrees, do you prioritise the subject or the institution?

Style

The way you present your information can show that you understand what the employer values. For example, if you're going for an academic post, it's a good idea to present your publications in a stratified way that reflects different levels of refereeing and quality control (i.e. status): books (indicate clearly if you're an author or an editor), book chapters (indicate if the chapter was invited or edited), refereed journal publications, refereed conference publications, other lesser publications. If you're going for an industry post, it's a good idea to make accessible the technical qualifications that relate to the post and to emphasise any indicators of customer or market awareness.

Academic CVs tend to be different from industrial CVs. There are times when you need to emphasise your technical qualifications and times when you need to show what a versatile and well-rounded person you are. The trick is to understand enough about the context into which you're sending your CV, in order to emphasise the appropriate things.

CVs change over time, as people develop. CV design choices will change over time, too. Choices that are appropriate for an early career CV will be less appropriate for a mature career CV, and vice versa.

Writing for the skim-reader

- Make every word count. Don't use 'Curriculum Vitae' as your major heading – it's a waste of words. Your name should be the principal heading
- The first page is crucial. Imagine that someone is trying to review half a dozen candidates and has spread the six CVs on the desk as an *aide-mémoire*. A good first page can make you more memorable, more impressive, more accessible. What you put on the first page should reflect what you think is most important for the purpose
- Be thoughtful in your use of typographic design; good design can help make important information accessible. White space and highlighting 'guide the

eye' – make sure the eye is guided to important information. If you just scan down the emboldened words, what do you read? Indenting and spacing can help group information. For example, ex-dented dates can make it easy to scan for continuity.

Writing for the scrutiniser

- Proofread! Then get someone else to proofread!
- The use of narrative trades off with scan-ability. Hence, use narrative sparingly and strategically, offering one or two lines to amplify or describe (e.g. indicating the significance of your doctoral work or highlighting the skills and responsibilities embodied in a previous job)
- Review your CV in the context of particular questions. Does it show continuity of activity? Are there any periods unaccounted for? Can the reader relate jobs to skills or outcomes in some way? Take questions from the job specification: what evidence does the CV provide that you meet the selection criteria?

What to avoid

- **Never lie in a CV:** but make the most of your history, selecting and highlighting relevant and important information. Don't call attention to things you'd prefer not to discuss. (If you lie, there's the horrible risk that you might get the job and then have to try teaching several courses on topics about which you know nothing. Or get fired when your employer finds out you lied)
- **Focus on content, not dressing:** don't get fancy or cute, it almost always backfires. Conveying information is the goal, not impressing with your decorative flair
- **Don't leave gaps:** if you do, employers will assume that you're concealing something, such as a spell in prison. If you were unemployed, then it's better to say so than to leave a gap; say something about how you used that time to prepare for the next job.

Applications and cover letters

People tend to talk a lot about CVs and overlook the application and cover letter, which are equally important. They are all part of soliciting an 'invitation to the ball'.

Why must you fill out an application when you've already provided a CV? Because selection panels receive lots (tens and hundreds) of applications and have an obligation to assess them fairly and comparably. The application form puts everyone's information into standard format. It also tells you what criteria are important to the organisation. Do ensure that the information you put on the application form matches the information in your CV.

What's the cover letter for? It's an opportunity to map your CV to the organisation's needs (the 'person specification') explicitly. Good cover letters are always written for the specific application (and, indeed, good CVs are tailored as well), and they echo language from the information for applicants to highlight the candidate's pertinent and distinguishing characteristics. The cover letter is an opportunity to convey your unique voice in a way that's more difficult in more standardised forms. Cover letters can count, either to your benefit if they are good, or to your detriment if they are bland or formulaic.

Job interviews

Some day, unless you do something very wrong or very silly, you will find yourself sweating outside an interview room, waiting to be interviewed for that all-important job. (They all appear all-important at the time – the first lectureship, the first permanent contract, the senior lectureship that shows you've made your mark, the readership that shows you've made your mark, the chair that shows you've made your mark, and so forth.) So, what do you do to help your chances of getting that job?

As usual, it's worth stepping back and having a careful think. You need to think about things such as whether you really want that job. When you're stressed about being employed, it's easy to grab for any straw that passes near your bit of the torrent, and to persuade yourself that the job you're applying for is exactly what you need to make your life perfect. There are some very nice jobs out there, but they're a minority, and are usually guarded with limpet-like tenacity by the incumbents (understandably). So, have a long hard think. If you realise that you're clutching at straws, then bear this in mind when you go for interview, and treat the interview as a chance to practise your technique.

This has various advantages:

- You will be less stressed, which is helpful in itself.
- You will get some useful interview practice.
- You will probably perform considerably better than usual, which is useful in itself and also practice for the future (there is, in fact, a real risk that you will be offered the job).

Preparation

A moment spent in reconnaissance is seldom wasted, to quote the sponsor of one of the earliest major scientific expeditions. Reading the information for candidates (department description, job description, person specification, etc.) is a good start. It's useful to know the department personally; you can do this via things like giving a seminar there, or striking up friendships at conferences. Reconnaissance has two major advantages: (a) it gives you a better basis for deciding if the job is one you want, and (b) panels treat candidates who've

'done their homework' as more serious, more competent and more willing to integrate into the department.

In the old days, the interview process started with a first-class letter arriving in the post at your home address inviting you to interview, and giving you information about how to get to the site, and about the time and the format of the interview, etc. Now, you're likely to get an email. It's wise to think about which email address you give when applying for jobs; if it's a private one, for whatever reason (e.g. you're between jobs, and can't use a university address) make sure it looks sensible.

If you're applying for a postdoctoral research post, then you need to use the grapevine and read between the lines of CVs on websites to find out what your potential bosses are like to work with. Will they work you like a dog, leave your name off publications, and ditch you as soon as the funding runs out? Are they pleasant people who will look after you, for instance, by finding more money for a follow-on project?

Find out what the institution is like, and how the department you're applying to presents itself. Examine its website and prospectus. What courses does it teach, how many staff does it have, how many students does it have (so you can work out staff–student ratios and therefore workloads)? Is there anything distinctive about its curriculum or teaching style? What are its research strengths? Who are the research leaders? How much have they published? Who is in the department – and who among those are you likely to work or want to collaborate with?

After this, you will have a better idea of how to pitch your application. More importantly, you'll have a better idea of whether you want the job in the first place. Something well worth remembering is that the job application process is two-way. You don't have to take the first job you're offered; you don't have to fit in with the requirements of the prospective employers if they don't match your goals. It's your life, not theirs.

Practicalia

What to wear

Academic dress conventions are usually fairly relaxed, but interviews are different. Go back to the viva chapter and the advice there. The panel will assume that what you wear to interview is your idea of what you would wear to a formal occasion. As with academic language and other expressive behaviours, you need to think functionally. What is the function of interview clothing? One function is simply to show that you have reasonable social skills and can be dragged out to help liaise with outside bodies if need be. For instance, if some people are needed to show moderately important visitors around, are you presentable enough to be turned loose? If you dress like the village idiot, then the answer is likely to be 'no', and that's one less possible use for you in the organisation's scheme of things (and, therefore, one less tick in the boxes that record your good points). Some other considerations:

- Some interview panel members look to see whether your shoes are immaculate, or scruffy and tatty. If the latter, then they'll suspect you of being the sort of person who does bad work and then tries to dress it up
- Most interviewees wear dark clothes. The reason for this will become apparent the first time you spill a drink in your lap two minutes before the interview, or have to sprint across a muddy car park to get to the interview room in time
- One game played by some panel members in boring interviews is spotting which interviewees are wearing a tie/suit/dress for the first time. It's usually a fairly easy game. If you're about to be interviewed, and plan to dress formally for the first time, then practise beforehand so the clothes don't distract you.

What to carry

Figure out what you need to take with you. Maps and directions. Plenty of cash (often useful when things don't go to plan). Something sustaining and un-messy to eat. The interview and job details – including the telephone number of the interview contact, in case there are travel delays. Your documentation, indexed for easy reference. Copies of any papers or other supporting material you might want to share with the panel. An extra shirt, tie or pair of tights (as appropriate), in case of accidents. Protection against adverse weather. A good book to distract yourself with.

Getting there

Usually, the convention is to do presentations in the morning and interviews in the afternoon. The candidates who come from furthest away are usually given the latest slots, to take some of the pressure off them in terms of travel. You will usually be sent a map, or directed to a website containing travel information.

There's no single right answer about whether to use public or private transport. Whichever you use, allow plenty of time for things going wrong and take plenty of cash. That way, if you have a disaster, you might well be able to rescue the situation. For example, if the train breaks down a stop too soon, get a taxi (which is why we recommend cash). If you spill tea down your best shirt, buy a new one. If the journey looks like being horrible, then consider travelling the day before and staying at a hotel overnight.

When you reach the site, it's a good idea to make your way to the contact point as soon as possible, to check that it really is where it appears on the map. Some universities have two sites at opposite ends of the town, for instance, and these regularly have trouble with candidates going to the wrong site. Identify yourself to the person handling the interviews, to let them know that you've arrived. If they haven't told you where the toilets are, then find out; either use your initiative, or ask in a polite, unapologetic tone. You can then do important things such as checking whether you have oil stains on your shirt, hair sticking up at the back of your head, and so forth. Then do something to relax: take a walk around (if you're not restricted by local security measures), or park yourself

in a corner and meditate, or read the good book that you brought with you for just this sort of situation.

Your presentation

It is common to ask candidates to do something in addition to the interview: to give a lecture on a specified topic to a specified audience, to give a research seminar, to prepare teaching material, to critique existing material, to provide an example of published work, to set out a research, and so on. These tasks are important: they give you a chance to demonstrate skill and raise interest, and they give the panel a chance to examine some concrete evidence of the claims you make in your application and/or CV. They also give you a hint about the sort of activity the panel considers important. Presentations in particular allow potential employers to see you in action.

The value of this practice for detecting good candidates is questionable, but it's surprisingly good at detecting bad ones. Very often, the presentation (and any questions afterwards) is when the rest of the department gets a chance to look over the candidates, and often one of them is designated to report the department's impressions to the interview panel. Things to bear in mind when presenting:

- Remember the cabinet-making metaphor – what skills do you need to demonstrate in your talk?
- Are you demonstrating all of the essential and most of the desirable skills from the job/person specification that came with the job details?
- What would encourage you about a candidate if you were on the interview panel?
- Have backups – if using PowerPoint or equivalent, then have hard copies of the slides as backups and be prepared to use a whiteboard if all else fails
- Do as many practice sessions as it takes to get the talk down to the right length, days before the interview. Give the talk to an empty room if you have to (though feedback from more experienced colleagues is very useful)
- Think about what the sensible, obvious approach to the topic is. That's what everyone else will be using. Then think about a sensible, non-obvious approach which they won't be using, preferably one that shows you are more mature and far-seeing than the competition
- Show some personality: if not passion, then at least enthusiasm and engagement.

Your interview

The interview panel will have a make-up determined by a variety of factors. The roles usually include some or more of the following:

- Someone from Human Resources to see that procedures are duly followed
- Someone external to see that the level of appointment is appropriate and that the panel isn't appointing someone underqualified out of desperation

- Someone from the department, who might have some idea what you're talking about
- Someone else from the department, to pad the department's vote and reduce the risk of the panel appointing someone disastrous as a result of its ignorance of the department's field of interest
- Yet another person from the department who disagrees with the first two, wants to appoint someone with diametrically different skills and who is too senior to keep away
- One or two senior people like the dean who want to keep an eye on what's going on and make sure the department is fitting in with the master plan
- Someone who has stood in at short notice for one of the above, to make up the numbers.

The panel will usually operate more or less in turn, and will usually ask you the same questions that they ask the other candidates. If one of the other candidates has some odd characteristics, then you may in the interests of comparability be asked the same question that the panel will ask them. The results can sometimes seem rather odd to the candidates who have not got a complex and obscure status regarding their nationality and work permits, for instance. If you're thrown by the question, you can always try asking the panel to expand on it, on the grounds that you're not quite sure what they're trying to ascertain.

The panel will (in theory) have agreed on their sequence and their questions beforehand. They will also (in theory) have a copy of the 'essential and desirable characteristics' list in front of them, and will tick off one by one the characteristics which you appear to have, with varying degrees of discretion.

Some panels then simply count the number of ticks and use that as a basis for appointment, which can lead to some scary decisions (hence the way that departments like to make sure they have the right people on the panel). There are numerous legal implications if a panel appoints someone who appears less qualified than an unsuccessful candidate, which is the reason for some of the odd-looking decisions. The great bonus about this, from your point of view, is that if you're clearly much better than the internal candidate, then you have a good chance of getting the job.

You need to make very sure that you get as many things ticked as possible: read the list of 'essential and desirable characteristics' with care, and refer explicitly to particular characteristics if you think that the panel might not realise that you have those characteristics. Don't assume that they will have read your CV in detail; err on the side of spelling things out explicitly. Anyone senior enough to be on the interview panel will usually have a ludicrous workload, and can be excused for forgetting that you're the candidate who worked for six months with the Bristol research group.

At interview, you will be concerned with showing the panel how wonderful you are, with a view to furthering your career. The panel will probably not give a damn about that. They will be concerned with their own agenda. This includes things like the following.

Departmental members

- Finding someone who can help out with teaching the SOD2001 module which nobody on the current departmental team can teach
- Finding someone to teach pretty much anything to the first-year students
- Finding someone to teach the complicated stuff to the final-year students and the MSc students
- Finding a good safe pair of hands who can help with departmental firefighting
- Finding someone who can strengthen the next research review or quality audit
- Finding someone pleasant to lessen the baleful presence of Professor Jones and Dr West
- Making sure they don't appoint anyone like Professor Jones and Dr West.

Other panel members

- Making sure the proprieties are observed and the forms are filled in correctly
- Making sure the institution can't be sued by dissatisfied candidates
- Making sure the department doesn't appoint someone dreadful out of rampant cronyism, like they did with Professor Jones
- Making sure the department doesn't appoint the first person who looks vaguely suitable out of sheer desperation from lack of staff, like they did with Dr West
- Getting the whole business over with as soon as possible because there's too much else to do.

The departmental agenda is usually the more important one from your point of view, and can be summed up in one question: what can this person do to make our lives better? If you come across as someone who can clearly fit one or more of the department's needs, then that's a very important step. If you ascertain what the department wants (e.g. by reading the information for candidates), then that makes life a lot easier for you.

Knowing your enemy

As ever, knowing your enemy is extremely important. If you're keen on research, then the standard researcher is one of your enemies, as the lists below should make clear. The standard researcher criteria for a good job are:

- Little or no teaching
- Little or no admin
- Few or no committee meetings
- As much autonomy as possible.

These differ subtly from the criteria which most departments use to describe a good candidate:

- Willing to do a reasonable amount of teaching
- Willing to shoulder their share of the admin
- Willing to help out with those boring committee meetings
- A team player.

The positive way to view this is to look at the phrasing in the departmental criteria. In a fair department, you will be expected to do your share of everything. That's not unreasonable. In an unfair department, you will be expected to do too much of everything. In a pathological department, you will be expected to do things which are a total waste of your time and expertise, and which damage your career and health. How can you as a novice tell which category your prospective department falls into? You probably can't. That's why you have a supervisor, and wonderful people to whom you can turn for advice.

Questions they might ask

Classics include the following:

'Did you have a good journey?', which means: 'You're probably feeling nervous; let's start gently.' It does not mean: 'We would dearly love to hear about the roadworks at Junction 14.'

'Would you like to tell us about yourself?' can be asked for various reasons, such as reminding the overworked panel whether you are the one from Southampton, or giving you a chance to describe yourself more coherently than you did on your CV. Whatever the reason, this is a good chance to summarise why you fit well with the essential and desirable skills.

'Why did you apply for this job?' can mean either, 'Why are you so clearly desperate to flee your present job?' or, 'Do you actually want this specific job, or would you settle for the first job that came along?' You need to be careful about the first of these, since you don't want to look like a vindictive failure. It's better in such cases to use a neutral phrasing which acknowledges that your present post is not for you, and that you've decided to move on. For the second meaning, you need to phrase your reply to show a well-informed appreciation of the good things about the department, and to show how you can help it.

'Where do you see yourself five years from now?' is a cliché, but a good one. It shows two main things, namely whether you're the sort of person who plans ahead, and what your schemes are for using the department to further your career. If you're either short of planning skills, or moving in a direction which will leave a trail of havoc through the department, then your chances of being appointed will probably dwindle.

'What would you teach if appointed?' Possible answers include the following, ranging from dreadful to good:

- 'Me? Teach?'
- 'I hadn't really thought about that'

- 'Something to do with human factors'
- 'Human–computer interaction; quantitative methods'
- 'I've taught system analysis and design at all levels from HND to MSc, so I could teach your SOD1001, SOD2001, SOD3001 and SOD4001 modules. I could also . . .'

Interviews are usually time-limited, so use the time well and don't waste it on content-free answers. Marshall your evidence. Follow up general statements ('I like working in collaboration') with reasons ('because it's a chance to combine strengths and be surprised by different perspectives') and concrete examples ('My collaboration with M.R. Wonderful on the meaning extraction project won a best paper award'). A job interview is a like a *viva voce* examination about *you*, so you'd better have mastered the topic. (Unlike the candidate we interviewed who, when asked to tell us about his thesis, replied, 'I didn't prepare about that!')

Questions you can ask

There are various questions you can ask. These are useful for two purposes. One is to find out things that you need to know, the other is to demonstrate to the panel that you're bright enough to ask the right questions and shrewd enough not to ask the wrong ones. There are plenty of things that you need to know (for instance, how likely is it that you will have an enormous teaching load dumped on you?) but which nobody in their senses is going to tell you; if you ask questions along these lines, then you show yourself as someone who does not understand the rules of the game. What you can ask is how the department would support you in doing the things that you really want to do, for example: 'I'm writing a grant proposal for detailed studies on how people read commercial websites. If the grant is awarded, will the department provide dedicated space for an eye-tracking lab?'

A better way of finding answers to these questions is via the grapevine. Questions which demonstrate that you have the right stuff will vary depending on the precise job, but if your question demonstrates a clear understanding of the department's teaching and research, then you probably won't go far wrong.

Once you've been offered the job, you can ask post-offer questions. This is where you negotiate, wrestle, wheel and deal with your potential employer. There's a trade-off here between getting what you want in the short term and antagonising your employer in the long term. It's reasonable to ask for clarification about exactly what's on offer, in terms of responsibilities, infrastructure (office, labs, equipment), support (secretarial and technical support, as well as things like travel funding) and flexibility when opportunities arise (like the award of a grant). It's also reasonable to negotiate conditions particular to your needs ('So you'll arrange my schedule to release Mondays so that I can continue my productive collaboration with Prof Smart?'). It's usually easier to do this after an offer is made and before it has been accepted, than after you've taken the post. There's also a certain grudging respect for those bold enough to

ask for justified resources commensurate with the post. Employers' amenability to negotiation tends to be proportional to the seniority (and salary) of the candidate. Just don't expect that the answer will always be yes. If there are particular things you want to be able to do (such as publish papers and attend conferences), then you need to ensure that they are either in the job description or accommodated in the terms and conditions. If they're not, then ask about them.

Ideally, find a 'home' that uses your strengths and puts you in an environment that compensates for your weaknesses. Find a setting which will allow you to grow and develop: hence, one that includes expertise, stimulating people and a lively community, a measure of flexibility and regard for initiative.

Chapter 18

Closing thoughts

We began with the metaphor of cabinet-making, and that's how we'll end.

The first point involves following your heart. Would you start an apprenticeship as a cabinet-maker if you weren't really interested in cabinet-making? Similarly, why spend several years of your life doing a PhD on a subject which doesn't excite you?

The next point is also about following your heart. During the PhD there will probably be some rough times. Reduce the stress of these times by keeping the PhD in perspective. It's just about learning how to make a professional-quality cabinet; it's not about having to produce a cabinet that will be the prize exhibit of the world's leading furniture museum. Similarly, blood comes first: if one of life's assorted tragedies hits you, you can take leave of absence from a PhD, but you can't take leave of absence from a loved one, or your health. The PhD is just an apprenticeship.

Learning will be painful at first: it always is. Accept that as part of the process and you will learn, and the pain will stop being an issue as it turns into growth. The great experts go on learning through their careers, and the learning involves humility – accepting that they don't know it all – and experimentation, and making mistakes, and learning from them.

During your time on the PhD, there will be plenty of occasions when you undergo doubt. When in doubt along the way, ask someone wise for advice. The apprentice who asks the expert about how to proceed is a better apprentice than those who don't recognise when they are out of their depth, and who damage a prime piece of timber through ignorance. Similarly, you'll have to make choices, both practical and ethical. When you have to make a choice, make one that you can look back on with a clear conscience in later years, when you are an expert and you are passing on your wisdom to the next generation of apprentices.

Finally, when your PhD is over, pass on some of your new wisdom to others at the start of their journey; make time to have that cup of coffee with the person whose life could be transformed by starting on the path to the destination you've just reached, particularly the people who have never thought that their lives could be much better. A kind and supportive word can make a lot of difference to a fellow human being.

This book is built on lessons from many students; we hope you've found it useful and enjoyable.

Some useful terms

Standard terms are well described in the standard textbooks. This section concentrates on non-standard terms which you may find useful and terms which are not as widely known as they should be. We have also included some terms which you may be guiltily aware that you're not sure about, even though you know you should be – for instance, what is the difference between a journal and a magazine, and how do these relate to periodicals?

big name: someone with a considerable reputation in the research community. Also known as 'an authority'.

Big Picture: the vision or strategy for your research. In a larger sense, the vision or strategy for your career.

blood in the water: unnecessary indication of serious weakness in your work.

bounced (of paper submitted to a conference or journal): euphemism for 'rejected'.

buzzword: fashionable but usually content-free word. If you're working in an area which is currently popular in the media (e.g. biotechnology or nanotechnology), then you need to make it clear in your writing that you understand the area thoroughly and are not just waving buzzwords around without understanding.

cabinet-making: the thesis is like the 'master piece' produced by apprentices in The Past. It is the piece of work which demonstrates that you have attained mastery of your chosen field. Like the apprentice, you need to make sure that your chosen piece of work, your thesis, gives you the opportunity to demonstrate the whole range of skills that you should have.

chair: professorship.

critical depth: what you're trying to demonstrate with a PhD, a healthy, 'mindful' scepticism that allows you to question assumptions and reasoning, and to consider the value of questions, evidence, techniques, claims – in short, of research – even-handedly and systematically.

cup of coffee: this is shorthand for an informal chat with someone. It usually does take place over a cup of coffee – the best departments are well aware of the importance of coffee rooms as places for informal exchange of information and for introducing PhD students to tacit information about the academic world.

duty of care: this is the core concept underpinning research ethics. You have an obligation to consider the impact of your research on any of those

involved in or affected by it, including (but not limited to) your participants, other researchers, those who fund your research and those who might use its outputs.

expressive behaviour: showing how you feel about something, as opposed to getting the job done (cf. *instrumental behaviour*).

eyeballing the data: this is an informal term for having a look at the raw data. This is a good idea if you're doing statistical analysis – if the results from the analysis don't look consistent with your impression from eyeballing the data, then there's a chance that you've made a mistake with the analysis. It's surprisingly easy to make mistakes, so eyeballing the data is a good habit.

field, the: has two meanings, which may be confusing for beginners. Sense 1: a discipline, or area of research. Sense 2: place, somewhere outside the lab/department, where data collection is conducted.

funded research project: if you want money to do some research, you can apply to various bodies for money (for instance, various research councils). Such funding bids range from a few hundred pounds for travel or equipment up to millions of pounds to set up a research institute. One common form of funded research project involves hiring a research assistant for one or two years to carry out the research specified in the funding bid. Bids of this sort bring money into universities and are an important part of research.

Good Thing: from the book *1066 and All That*. This is an ironic reference to things which are currently fashionable, with the implication that before long they will be out of fashion and replaced by some other fad.

Great Departmental Report: most departments publish reports on their teaching and/or research at various intervals. This is usually because they are required to do so by some higher authority, such as the faculty or university, rather than because they want to. These reports are usually a thorough irritation to everyone involved, not least because they usually want information from you in a format which is as inconvenient as possible. They will also probably want to know the exact dates of any conferences at which you presented a paper, and the ISBN or ISSN for any publications. If you haven't kept records of these, then The System will probably hound you mercilessly until you track them down. The moral is to keep neat and complete records of publications (or, failing that, complete records – just putting all the paperwork from the conference in a folder to sort through later will probably be adequate).

harmless: a low-key insult. Describes something which is devoid of any particular good or bad features, but which will attract so little attention because of its mediocrity that it will do no harm to the world (e.g. 'a harmless paper').

inaugural: formal lecture given to colleagues and invited guests by a newly appointed professor, to mark their appointment.

inflating your *p* value: using an unnecessarily large sample size, so that a weak effect is statistically magnified to an unjustified extent. In some fields, weak effects are extremely important; however, in most fields, the majority of weak effects are trivial and not worth bothering with.

instrumental behaviour: getting the job done, as opposed to showing how you feel about it (cf. *expressive behaviour*).

journal: a learned periodical, aimed at a particular discipline. Differs from a magazine in several ways. Journals are intended for specialists, not general readers, and normally journal articles are written by academics, not journalists. More prestigious academically than magazines, having one of your articles published in a good journal is a sign of professional achievement.

named candidate: when you're writing a funding bid (to ask for money for a research project), some funding bodies like to know that you have already lined someone up to do the work if you get the money – it can be difficult to find someone with suitable skills for a specialist area of research, and a surprising number of projects fail because nobody suitable could be found to do the work. The named candidate is the person lined up to do the work; wise researchers are usually on the lookout for potential named candidates, such as PhD students who appear to know the unwritten rules.

operationalise: mapping from what we want to know to what we can investigate empirically – that is, to what we can observe in the world. It's important to realise that things we capture – recordings, descriptions, categorisations, measures – are not the whole phenomenon, and getting the mapping wrong leads to invalid conclusions.

Past, The: we've capitalized this to mark ironic humour. People tend to think of The Past as a fairly homogeneous time of slow changes, whereas the reality is rather different. In the case of the PhD, for instance, the nature of the doctorate has been changing at a noticeable rate throughout living memory, and probably throughout history. This misconception of The Past can be a serious issue if a central part of your thesis involves claims of unprecedented changes in some area within the last few years; fortunately, a full discussion of this is outside the scope of this glossary.

periodical: a publication which comes out periodically, usually several times a year, such as a journal or a magazine, and in contrast to one-off publications such as books.

PhD: formal abbreviation for Latin *philosophiae doctor* (doctor of philosophy). Highest regular university degree, usually given to a candidate who has successfully presented a written thesis on a research topic and passed a *viva voce* examination. There are also other doctoral qualifications with different abbreviations in disciplines such as theology. As usual, conventions vary across institutions and disciplines. People with a PhD can call themselves 'doctor', a rich source of argument with medical doctors, with each side viewing the other as interlopers.

practicalia: low-level practical things, like making sure you have enough paperclips, or getting a form filled in by the deadline.

professor: academic title; the top academic (as opposed to administrative) title. You do not need to have a doctorate to be a professor, though it is usual. Becoming a professor is equivalent to becoming one of the senior elders in a traditional clan society. Becoming a professor before 40 is usually viewed as a sign of a bright young thing.

protocol: the 'script' for an empirical study which specifies the design in full operational detail.

questionnaire: usually refers to a collection of poorly validated questions assembled without much thought about how they will be analysed, and with even less attention to the literature on good practice in data collection and in surveys. Much favoured by those who believe that it is better to collect large amounts of meaningless data than the right amount of meaningful data.

research metrics and assessment exercises: in the name of quality control, The System periodically asks universities to present data about their publications and other research activities. The better a university's research, the more money it is given by The System. What does 'better' mean? Good question. Shrewd departments have a fair idea of what will count as 'better' and will encourage it (usually papers in top journals and substantial income generation from research are in this category).

Reader: academic rank intermediate between lecturer and professor, specialising in research rather than administration. Usually Readers go on to be a professor fairly soon. We have spelled the term with a capital 'R' to reduce confusion and the scope for witticisms.

reducing the problem space: eliminating plausible but wrong possibilities so you can narrow down the set of possibilities which might be correct.

research assistant: a person who is employed to carry out research on a funded research project. Most PhD students go on to work as a postdoctoral research assistant for a few years after graduating, as a useful way of gaining experience. Once tellingly described as a 'research grunt' by a cynical colleague in that role (an allusion to the US Marine Corps which will probably be lost on most readers, but which might bring amusement to some).

research community: research in any given area involves a number of researchers; usually this number is surprisingly small, since fields tend to subdivide into manageably small subfields. All of the big names, and most of the leading researchers, will usually know each other, at least by name and reputation; they will normally meet at conferences each year. The usual career path is to find a research area which interests you and then to build a reputation within that research community.

research fellow: means different things in different institutions, ranging from a research assistant with a PhD to a very senior and very prestigious research post at a prestigious university.

rhetoric: the art of communication and persuasion.

rigour: the systematic pursuit of validity – and vigilance against bias – through disciplined practice and reasoning.

sample size: usually a very large number, selected for no obvious reason, and without reference to the various statistical tests which can be used to show when diminishing returns have been reached and when there is no point in collecting more data.

sanity check: a test, usually informal, to check that a claim or a finding is not obviously silly. Useful when you're using statistical software for the first time and there's a risk of an error producing output which is in the correct format but which is completely wrong.

significant: has a specialised statistical meaning, which can lead to serious misunderstandings for students who are unaware of this and who use the word in the loose, popular sense. In statistics, 'significant' means 'the likelihood of this happening by random chance is at most 1 in 20'; this is normally accompanied by naming the statistical test which was used. 'Highly significant' and 'very highly significant' involve the same principle, but with odds of 1 in 100 and 1 in 1000 respectively.

significant absence: something whose absence tells you something significant. In a Sherlock Holmes story, the main clue is that the watchdog did not bark when the criminal entered the premises. This absence of barking was significant, and showed that the dog knew the criminal. If the dog had been a friendly creature that never barked at anyone, then the absence of barking would not have been a significant absence. Academic significant absences usually take the form of no reputable published accounts of a particular phenomenon or effect. Learning to spot significant absences takes time, but is an invaluable skill.

System, The: ironic reference to the image, widespread among students and supervisors alike, of the higher reaches of the university as being an unholy hybrid spawned by the imaginations of Kafka, Lovecraft, Orwell and Stalin.

tacit knowledge: in the broad sense, knowledge which is not usually mentioned explicitly, whether because it is taken for granted, or because it is about a sensitive topic. Much expertise consists of tacit knowledge, and acquiring it is an important part of doing a PhD This topic usually isn't addressed in PhD training courses or books, and is usually left to the supervisor, if indeed anyone thinks explicitly about it at all.

there is a literature on that: a middle-key insult that means, 'That topic has been thoroughly studied by a large number of people, and you have clearly

failed to do your homework and discover it; also, you have just wasted a chunk of your life reinventing the wheel.'

viva: short for Latin *viva voce*. A live interrogation, usually by external examiners, to test your knowledge of your chosen subject. The final stage of a PhD may also be used on MSc and undergraduate students on occasion. In some countries, the viva takes place as a public event open to anyone who feels like coming along to the lecture hall where it is held; in The Past, as a further aid to students' nerves, vivas were held in Latin, so if you're feeling worried about your own viva, then count yourself lucky that you aren't having it in sixteenth-century Paris.

voice: somewhere between style and viewpoint. For instance, the voice in which a paper is written may be austere, or informal, and/or authoritative. The same word is used in a different sense in traditional grammar.

Some further reading

This section consists, like the rest of this book, mainly of things that don't usually appear in other books on this topic (some of which may seem improbable), and is intended to complement the standard-issue 'further reading' sections rather than to duplicate or supplant them.

Phil Agre, on 'Networking the network':

http://polaris.gseis.ucla.edu/pagre/

Phil Agre has a site full of interesting material. This part is our favourite.

Richard Bolles, on what you want to be when you grow up:

Bolles, R.N. (2009) *What Colour is Your Parachute?: A Practical Manual for Job-hunters and Career Changers*. Berkeley, CA: Ten Speed Press.

There's a reason that this book has been around in various editions for 30 years. It has lots of excellent exercises to help you work out exactly what you want from life; however, it was written by an ordained Episcopal priest, and so it has a certain coloration.

Judith Butcher, on copy-editing:

Butcher, J., Drake, C. and Leach, M. (2006) *Butcher's Copy-editing: The Cambridge Handbook for Editors, Copy-editors and Proofreaders*, 4th edn. Cambridge: Cambridge University Press.

The classic book on copy-editing; invaluable for doing a professional job when the proofs come back with a note asking you to check them within two working days.

Tony Buzan, on producing mindmaps:

Buzan, T. (1997) *The Mindmap Book*. London: BBC Books.

Mindmaps are a handy way of taking notes or making brain dumps.

Alan Chalmers, on the philosophy of science:

Chalmers, A.F. (1999) *What is This Thing Called Science?*, 3rd edn. Maidenhead: Open University Press.

A useful and digestible introduction to the philosophy of science, just the thing for the bathtub or a train ride.

Chris Chatfield, on statistics:

> Chatfield, C. (1995) *Problem Solving: A Statistician's Guide,* 2nd edn. London: Chapman & Hall/CRC Press.

Chatfield gives a thoughtful, accessible introduction to thinking about real data and from that sorting out strategies for statistical analysis. The book is concerned with solving problems rather than just using techniques.

John W. Creswell, on research methods:

> Creswell, J.W. (2018) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 5th edn, New York: Sage Publications.

Creswell opens with a nice overview of epistemology, admittedly from a social science perspective (but not an overbearing one).

Edward de Bono, on creative thinking:

> de Bono, E. (1999) *de Bono's Thinking Course.* London: BBC Books.

We may not love de Bono, but you might, and he's a cultural reference that comes in handy.

Lyn DuPré, on improving your writing:

> DuPré, L. (1998) *BUGS in Writing, Revised Edition: A Guide to Debugging Your Prose.* Reading, MA: Addison-Wesley.

A practical, nuts-and-bolts guide to English usage that combines wit with mastery.

Ben Goldacre, on the nature of evidence:

> Goldacre, B. (2008) *Bad Science.* London: Fourth Estate.

Goldacre offers a highly amusing and well-written critique of how evidence is used and abused – including how evidence is distorted in the service of marketing. This book is consistent with our chapters about evidence and critical thinking – but funnier.

Stephen Jay Gould's books of essays:

Useful for helping students to appreciate the scholarship of previous centuries in context, rather than as a quaint collection of mistaken and discarded beliefs.

Sir Ernest Gowers, on effective writing:

> Gowers, E. (revised by Greenbaum, S. and Whitcut, J.) (2003) *The Complete Plain Words*. Harmondsworth: Penguin.

The classic advice on writing: 'Keep it simple, stupid.'

Herodotus:

> Herodotus, Marincola, J.M. and De Selincourt, A. (1996 edition) *The Histories*. Harmondsworth: Penguin.

A wonderful example of uncritical but scrupulously accurate reporting. We often use Herodotus as a contrast to Thucydides for purposes such as explaining the difference between a literature report (Herodotus) and a literature review (Thucydides).

Darrell Huff, on statistics:

> Huff, D. (2003 reissue) *How to Lie with Statistics*. London: W.W. Norton.

Once celebrated as 'blasphemy against the religion of statistics', this delightfully readable book is a classic on the use and abuse of statistics. Huff is a salutary reminder to *pay attention to the evidence*.

Susan Jeffers, on dealing with frustration, indecision and self-doubt:

> Jeffers, S. (2007) *Feel the Fear and Do It Anyway,* 20th anniversary edn. London: Vermillion/Random House.

This is one of a slew of self-help books, the sort of thing you read over a coffee and, if the moment is right, use constructively. If you're really keen, there's a whole industry that goes along with the book; visit www.susanjeffers.com

John Malouff, on problem-solving techniques:

> Malouff, J. (2008) *Over Fifty Problem Solving Strategies Explained*. Available at: www.une.edu.au/bcss/psychology/john-malouff/problem-solving.php

This is a compendium of problem strategies gathered from a variety of sources.

Kenneth May, on using a card index:

> May, K.O. (1973) *Bibliography and Research Manual of the History of Mathematics*. Toronto: University of Toronto Press.

Pages 2–27 offer a system for maintaining a card index.

Scott McCloud, on comics:

McCloud, S. (1993) *Understanding Comics: The Invisible Art.* New York: Harper Perennial.

A sideways introduction to storytelling and rhetoric.

David Patterson, on 'How to have a bad career in research/academia':

www.cs.berkeley.edu/%7Epattrsn/talks/BadCareer.pdf

These are slides from a talk by David Patterson offering advice that is wickedly and memorably to the point.

Estelle M. Philips and Derek S. Pugh, on how to get a PhD:

Philips, E.M. and Pugh, D.S. (2005) *How to Get a PhD: A Handbook for Students and their Supervisors*, 4rd edn. Maidenhead: Open University Press.

There's a good reason why this book has sold so many copies year after year. It's an excellent overview of the PhD process – indeed, we have always considered our book as a complement to Philips and Pugh.

George Pólya, on reasoning and problem-solving:

Pólya, G. (1971) *How to Solve It: A New Aspect of Mathematical Method.* Princeton, NJ: Princeton University Press.

Although an introduction to mathematical problem-solving might seem irrelevant, it's not. Good research is about good reasoning, and Pólya's book is a fine excuse to explore and reflect on strategies for problem-solving.

Fred Ramsay and Daniel Schafer, on strategies and tools for modern statistical data analysis:

Ramsay, F. and Schafer, D. (2001) *The Statistical Sleuth*, 2nd edn. Boston, MA: Cengage.

Robert Rosenthal and Ralph Rosnow, on human-participants studies:

Rosenthal, R. and Rosnow, R.L. (2008) *Essentials of Behavioural Research: Methods and Data Analysis*, 3rd edn. New York: McGraw-Hill.

There are numerous textbooks and reference works on research methods involving human participants. If you were only to read one, this would be a safe choice. But it would take you a long time.

Donald Schön, on reflective practice:

> Schön, D. (1984) *The Reflective Practitioner: How Professionals Think in Action*. London: Temple Smith.

Schön promotes critical self-reflection and articulates that professional excellence arises from 'reflection in practice', a continual feedback loop of experience, learning and practice. A useful (and highly influential) perspective.

The **Skeptic's Encyclopedia,** on reasoning and evidence:

> http://skepdic.com/contents.html

Very useful for practice in reasoning, logic and use of evidence.

William Strunk, Jr. and E.B. White, on writing right (sorry, we couldn't resist that one):

> Strunk, W., Jr. and White, E.B. (1979) *The Elements of Style*. New York: Macmillan.

This is a fundamental guide to English usage. Every writer should have it, and should have read it.

Robert H. Thouless, on reasoning and thought:

> Thouless, R.H. (1995) *Straight and Crooked Thinking*. London: Macmillan.

This is a book about argument and intellectual engagement set in the context of human emotion and psychology. It articulates a range of pitfalls in argumentation. Students would do well to use the appendix on 'Thirty-eight dishonest tricks which are commonly used in argument' as a checklist for debugging their dissertations.

Thucydides, on rigorous thinking:

> Thucydides, Warner, R. and Finley, M.I. (1954) *History of the Peloponnesian War*. Harmondsworth: Penguin.

Most students have a certain degree of condescension towards work done before they were born, and this can lead to dangerous habits and sloppy scholarship. Thucydides' writing and reasoning (for instance, his analysis of the size and significance of the Trojan War) help students understand how much there is to gain from treating the literature seriously, however old it is.

Edward Tufte, on visual presentation of data:

Tufte, E.R. (2001) *The Visual Display of Quantitative Information*, 2nd edn. Cheshire, CT: Graphics Press.

The canon on visual design for graphical presentation of numerical data. Elegant, lavish, lucid, diverting and informative.

The urban legends FAQ:

https://urbanlegendsonline.com/faq/

Generally entertaining (though often gruesome); good for teaching students caution when deciding which statements need to be checked and which statements are known by everyone to be true.

Vitae, on an establishment view of PhDs and early research careers:

http://www.vitae.ac.uk/

'Vitae is a national (UK) organisation championing the personal, professional and career development of doctoral researchers and research staff in higher education institutions and research institutes.' Actually, the site has all sorts of useful material, do look.

Wikipedia sections on rhetoric and on logical fallacies:

http://en2.wikipedia.org/wiki/Rhetoric
http://en.wikipedia.org/wiki/Fallacy

Most students have room for improvement as regards seeing errors either in their own reasoning or in the texts they are using. The Wikipedia site is one of several modern sites which provide accessible introductions to this via understanding rhetoric and logical fallacies.

Trevor Young, on project management (and why projects fail):

Young, T.L. (2013) *Successful Project Management*, 4th edn. London: Kogan Page.

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Open University Press
McGraw-Hill

The Unwritten Rules of PhD Research

Third Edition

"The course of a PhD never did 'run smooth'. This new edition of unwritten rules covers everything the doctoral student needs to know for a smoother passage with informal yet scholarly advice, ranging from improving the writing process, creating networks, completing the thesis, and even what to wear for the viva – a complete guide to the tacit guidelines sometimes left unsaid."
Professor Jerry Wellington, The University of Sheffield, UK

Returning in its 3rd edition, this bestselling book on the process of PhD research provides friendly, engaging, and realistic advice on how to complete your doctorate.

Updated throughout, the book will guide you through the basics as well as covering aspects that other books don't usually mention, including:

- What a PhD is really about and how to do one well
- How to decipher what your supervisor actually means by terms like 'good referencing' and 'clean research question'
- How to design, report and defend your research

The authors offer an accessible, down-to-earth, and insightful account of the whole PhD process. Their advice addresses how to avoid some of the pitfalls en route to a successful submission.

Key features:

- Thinking about your career from the outset of your PhD (rather than at the end)
- Tips for 'sniffing' a paper to make your reading quicker and more efficient
- Understanding cultural differences in research
- Networking for research success
- Sensible guidelines for using social media in your research
- Guidance on project management – especially important for part-time students

The *Unwritten Rules of PhD Research* is essential reading for anyone considering a PhD, embarking on one, or stuck in the middle and unsure where to turn. It will tell you things many students wish someone had told them before they started.

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