Part II
Sections of a Paper

Chapter 11
Titles

What key skills are needed when writing a Title?

Browsers on the Internet looking for a paper may read hundreds of titles before they select an Abstract to read. According to one of Britain's top editors, writing good headlines represents about 50% of the skills vital to article writing. For this reason the gurus of research writing tend to dedicate more pages to discussing the importance of the title than they do to any section in the paper itself.

Every word in your title is important. So the key is to devise a title that:

1. will immediately make sense to the referee
2. will easily be found by a search engine or indexing system
3. will attract the right kind of readers rather than discouraging them, and will also catch the attention of browsers. Note 'attraction' does not mean resorting to newspaper-like headlines, but simply containing those words that readers in your field would expect to find
4. does not consist of a string of nouns and will be immediately comprehensible to anyone in your general field
5. is short
6. has a definite and concise indication of what it is written in the paper itself. It is neither unjustifiably specific nor too vague or generic

The rules for writing good titles reflect the rules on writing skills in Part 1 of this book.

Note that all the rules relating to titles given in this chapter are also valid for headings, subheadings, and legends / captions. They are also valid for book titles and chapter titles.

A. Wallwork, *English for Writing Research Papers*,
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Typical complaints of Referees

The title is too generic ("A general strategy"…): it should be more informative of the content of the manuscript (e.g. A procedure for the extraction of vitamin B from ….)

This manuscript is of sound science but there are a few problems with how it is written. The title is rather misleading: it mentions a specific pathology in a specific fruit (kiwi). However, the focus of the paper is on the pathology, the aspect of it being in kiwi seems secondary. An alternative title, which omits kiwi, would be …

As it stands, the title is just a sequence of nouns. I only understood the meaning of the title after I had read the abstract and introduction.

11.1 How can I generate a title?

Think about the following questions:

- What have I found that will attract attention?
- What is new, different and interesting about my findings?
- What are the 3–5 key words that highlight what makes my research and my findings unique?

On the basis of your answers you should be able to formulate a title.

11.2 How can I make my title more dynamic?

Every word (apart from articles and prepositions) included in the title should add significance. The following words in italics rarely add value.

S1. **A study of* the factors affecting the trihyroxyindole procedure for the analysis of deoxyribonucleic acid

S2. **An investigation into* some psychological aspects of English pronunciation

The first seven words in S1 give the reader no information. S1 and S2 might be more dynamic and more concise if the initial redundant words were removed.

S3. Factors affecting the trihyroxyindole procedure for the analysis of deoxyribonucleic acid

S4. Some psychological aspects of English pronunciation

Similar words that are often redundant are: *inquiry, analysis, evaluation,* and *assessment.*

However, words such as *study* and *investigation* may be useful to make your research sound less conclusive. S5 sounds like the authors have made the definitive study (i.e. the final settlement or decision) of customer satisfaction, whereas S6 sounds less arrogant and more open.

S5. *The determinants of customer satisfaction

S6. An investigation into the determinants of customer satisfaction

However, simply replacing *the* with *some* (S7) or removing it completely (S8) would also make the research seem less definitive.

S7. Some determinants of customer satisfaction

S8. Determinants of customer satisfaction

Another occasion where words such as *study* and *investigation* may be useful is in two-part titles. For example:

S9. Old age: A study of diversity among men and women

However, S9 might have more impact as follows:

S10. Old age: diversity among men and women

S10 could also be rewritten as a question.

S11. What factors effect diversity among men and women in old age?

But S11 still contains redundancy and is not particularly eye-catching. Better might be:

S12. Will women always live longer than men?

11.3 Can I use my title to make a claim?

Many referees and journals editors do not appreciate authors who use the title to present their major conclusion and thus perhaps overstate the importance of their findings. For example:

The consumption of one apple per day precludes the necessity of using medical services

The above is what is known as a declarative title. It summarizes the author's most important findings, as a complete sentence (i.e. with subject – verb - object). It does so in a way that there seems to be no element of doubt. However, if the author's conclusions are only speculations, then such declarative titles are dangerous. This is because they give readers the initial idea that the issue has been settled and that what the author asserts is now scientific fact.

Such titles are increasingly common in medicine and biology, and may be acceptable if well documented. Such titles also get your paper noticed and potential readers may thus become stimulated into reading your paper. The important thing is to ensure that the title reflects the truth and is supported by the rest of the paper.

Before using a declarative title check with other titles in your chosen journal.

11.4 Are questions in titles a good way to attract attention?

The titles below highlight that a question can be formulated using an auxiliary (e.g. *does, would, can, will*) and using question words (e.g. *why, when, what, which, why, who*).

Does the ocean-atmosphere system have more than one stable mode of operation?

If homo economicus could choose his own utility function, would he want one with a conscience?

Why Do Some Countries Produce So Much More Output Per Worker Than Others?

When do foreign-language readers look up the meaning of unfamiliar words? The influence of task and learner variables

What do bosses do? The origins and functions of hierarchy in capitalist production

Who would have thought it? An operation proves to be the most effective therapy for adult-onset diabetes mellitus.

Titles with questions also work particularly well for abstracts submitted to conferences. They are generally much more informal and because of their question form they immediately get readers thinking about what the answer might be. They can also be original and fun, as highlighted by the last title. They thus tend to stand out from other titles and are more likely to attract attention.

11.5 When is a two-part title a good idea?

The fifth and sixth titles in Sect. 11.4 are examples of a two-part title. In these cases the first part poses a question, which the second part answers.

In other cases the second part acts as an explanation for the first part:

> Consequences of erudite vernacular utilized irrespective of necessity: problems of using long words needlessly
>
> The role of medicine: dream, mirage or nemesis
>
> Telling more than we can know: Verbal reports on mental processes

Given that two-part titles are much less common than other titles they generally attract more attention, and like questions work well for abstracts submitted to conferences.

11.6 How should I punctuate my title?

The two parts of the titles in Sect. 11.5 are separated by a colon. Some journals require a capital letter after a colon, as in the last example.

Titles never end with a period (.), but if they are questions, then there should be a question mark at the end (see examples in Sect. 11.4).

11.7 What words should I capitalize?

There are basically two ways to capitalize a title. The first is to capitalize each initial letter, apart from articles (*a, an, the*) and prepositions (e.g. *on, by, in, of*). You can see examples of this in Sect. 11.8.

The other is just to capitalize the first letter of the first word, and then to have all the other words in lower case. Of course, if the word is a proper noun, then this should have an initial capital letter too. You can see examples of this in Sect. 11.5.

Check which system is used in your chosen journal.

11.8 What types of words should I try to include?

Where possible use the *-ing* form of verbs rather than abstract nouns. This will make your title more readable as well as making it 2–3 words shorter.

ABSTRACT NOUNS	VERBS
The *Specification* and the *Evaluation* of Educational Software in Primary Schools	*Specifying* and *Evaluating* Educational Software in Primary Schools
Methods for the *Comparison* of Indian and British Governmental Systems in the 19th century	Methods for *Comparing* Indian and British Governmental Systems in the 19th century
A Natural Language for Problem *Solution* in Cross Cultural Communication	A Natural Language for *Solving* Problems in Cross Cultural Communication
Silicon Wafer Mechanical Strength *Measurement* for Surface Damage *Quantification*	*Quantifying* Surface Damage by *Measuring* the Mechanical Strength of Silicon Wafers

The key words in your title are likely to be nouns. So choose these nouns very carefully. The key words in the first title above are *educational software* and *primary schools*.

Try to choose adjectives that indicate the unique features of your work, e.g. *low cost, scalable, robust, powerful*. Adjectives such as *reliable* should only be used if work in your field has so far only produced an unreliable system or unreliable results.

11.9 What other criteria should I use to decide whether to include certain words or not?

You can use an Advanced Scholar Search to check how frequently a word in your title is used. Under the form 'Find articles' insert your word or combination of words into the 'with the exact phrase' field. Then in the 'where my words occur' field, choose 'in the title of the article'.

Let's imagine that you want the readers to know how great your research is and you want to choose an adjective, such as the ones in the table below, to emphasize the importance of your work.

ADJECTIVE	NUMBER OF RETURNS
cutting edge	6,500
innovative	100,000
novel	550,000
new	130,000

The above table could be interpreted as indicating that the lower the number of returns, the less frequent the adjective is and therefore the more noticeable it is.

If the word you choose gets less than a few thousand returns and it is not a specifically technical then you should check whether the authors:

- are native speakers
- use the word in the same way and in the same kind of context as you do

If the answer to either of the above is 'no', then you need to think of another word.

For example, the title below may make sense in the native language of the author, but when translated into English it sounds rather strange:

> A study on the use of oils and colorants in Roman cosmetics: a witness of make-up preparation

The problem word is *witness*, which is here being used to mean *evidence* or *example*. A search on Google Scholar for "a witness" only gives 1,300 returns, which is very low given that the concept of evidence and examples is very common in research. Also, a quick look at the titles in which the term *witness* appears quickly indicates that *witness* is generally confined to a legal context meaning someone who sees something, it thus refers to a human subject whereas make-up is inanimate. You can also see words in context on wordnik.com.

11.10 Will adjectives such as *innovative* and *novel* attract attention?

What the table in Sect. 11.9 also indicates is that the titles of many millions of other papers do not have such adjectives in their titles. This is because the other words in the title should enable readers to understand whether your work is innovative or not, without you having to use *innovative* and *novel* to tell them so.

The problem with *novel* and *innovative* is that they give no indication as to how something is novel. For example, what does *novel* mean in the following title?

> A novel method for learning English

If your research is not novel then no one would want to read about it anyway. You need to explain to readers what makes it novel. More explicit adjectives to replace *novel* could be: *computerized, guaranteed, high-performance, low-cost, minimal-stress, no-cost, pain-free.*

Finally, no one is likely to include the words *novel* or *innovative* when Googling papers in their field.

11.11 How can I make my title shorter?

Titles are often constricted by the number of characters that can be used (check with your journal to see how many words or characters you can use). In some cases you can keep your title as it is but reduce it in length simply by replacing the non-key words with shorter synonyms.

LONG VERB	SHORT VERB	LONG NOUN	SHORT NOUN
achieve	gain	advantages	gain, benefits, pros
apportion	allot	examination, investigation	study
calculate, evaluate	assess, rate	improvement	advance
demonstrate, display, exhibit	show	modification	change
determine	fix	LONG ADJECTIVE	SHORT ADJECTIVE
facilitate	ease	accurate	exact
guarantee	ensure	fundamental	basic
prohibit	block	important	key, top
require	need	innovative	novel, new
support	aid	necessary	needed
utilize	use	primary	main

The most obvious ways to make your title shorter are to:

- choose the shortest word (for more examples see Sect. 5.8)
- remove redundant words (see Sect. 5.3)
- use verbs rather than nouns (see Sects. 5.4 and 5.5)

11.12 Is it a good idea to make my title concise by having a string of nouns?

The title in S1 is almost incomprehensible for a reader.

S1. *Cultural heritage audiovisual material multilingual search gathering requirements

However, for the author S1 will be perfectly clear. You, as an author, know exactly what your title means and so for you it does not seem a problem to put lots of nouns together with no prepositions or verbs. Some of my students have even told me that it to them it seems "more English and more elegant". This is simply not the case. A much clearer version of S1 is S2.

S2. Gathering requirements for multilingual searches for audiovisual materials in the cultural heritage

Below are some more examples.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Educational software specification definitions trends	Trends in defining the specifications for educational software
Examining narrative cinema fiction and fact boundaries	Examining the boundaries between fiction and fact in narrative cinema
New archaeological research and teaching technologies	New technologies for research and teaching in archaeology

What the RVs highlight is that the order of the nouns has been reversed. In the OVs there is a series of nouns that premodify (describe) the final noun. However, these final nouns (*trends, boundaries, technologies*) are not usually used in English in combination with another noun.

Melanie Bell, who researches English language at the University of Cambridge, comments:

> Although native speakers string nouns together, especially when coining terms in technical language, it's probably safer to avoid creating multiword compounds of more than two, or perhaps three, words. English tends to be clearer if nouns are not used in a long string but are broken up by the use of prepositions and verbs that show how the nouns are related to one another.

The OVs are examples of concatenations of nouns, and the RVs represent phrasal options. By 'coining terms' Bell means creating a combination of nouns that has never existed before: *specification definitions trends* and *fact boundaries* are examples of such combinations. The difference between a native speaker and a non-native speaker, is that a native speaker intuitively knows whether a combination sounds right or not, whereas a non-native rarely has this ability. If you are not sure whether a combination exists or not, then check with Google Scholar. If you are combining relatively common words (including technical words) and you don't get at least 100,000 returns, there is a good chance that your combination of nouns does not exist. In such cases you can simply adopt the method highlighted in the RVs. This method involves using verbs (Sect. 11.8) and prepositions (Sect. 11.13).

However, strings of nouns and adjectives must be used if they are names of pieces of equipment or procedures. Here are some examples taken from the Methods section of three papers.

> An Oxford Link SATW ultra-thin window EDX detector
>
> A Hitachi S3500N environmental scanning electron microscope
>
> A recently developed reverse Monte Carlo quantification method

For more on this topic see Sects. 2.14 and 2.15.

11.13 Should I use prepositions?

Most titles of more than about five words require prepositions. The table below explains the typical meanings of prepositions in titles, and gives some examples with and without prepositions.

	MEANING	POOR / INCORRECT ENGLISH	GOOD ENGLISH
by	how something is done	Fast computing machines equation of state calculations	Equation of state calculations *by* fast computing machines
for	for the purpose of	Depression measuring inventory	An inventory *for* measuring depression
from	the origin of	Antonio Gramsci prison notebooks selections	Selections *from* the prison notebooks of Antonio Gramsci
in	where something is located, what something regards	Vertical flux of ocean particles Classical theory of elasticity crack problems	Vertical flux of particles *in* the ocean Crack problems *in* the classical theory of elasticity
of	belonging to, regarding	Reality social construction Model dimension estimation Cancer causes: cancer avoidable risks quantitative estimates	The social construction *of* reality Estimating the dimension *of* a model The causes *of* cancer: quantitative estimates *of* avoidable risks *of* cancer

Even if you don't understand the exact meaning of the above titles, the important thing to note is that the use of prepositions helps the reader to understand how the various elements in the title are related to each other. Also note that rewriting a title so that it contains prepositions may involve adding *a/an* or *the* (see Sects. 6.6 and 11.14). Such cases are underlined in the table.

I have given more examples of the preposition *of* than for the other prepositions because the non-use of *of* tends to create more difficulties for the reader than any other preposition.

Do not worry if you use the same preposition more than once in the same title. For example *of* is used three times in the last title in the table above. This is perfectly acceptable and is not considered bad style in English.

11.14 Are articles (*a / an, the*) necessary?

Although a title is not generally a complete sentence, it does have to be grammatically correct. This means that it must have articles where necessary, even though this will increase the length of the title.

S1. *Survey of importance of improving design of internal systems

S2. A survey of the importance of improving the design of internal systems

S1 is not correct English. A general rule of English is that a countable noun that is in the singular must be preceded by an article. In S1, *survey* is a singular countable noun, so it must be preceded by either *a* or *the*. In S2, *a* is the correct choice because we are not referring to a survey that the reader already knows about. An example of where *the* would be necessary is in S3, which is part of a literature review:

S3. Two surveys on x have been reported in the literature, *the* survey conducted by Williams is more comprehensive than *the* survey carried out by Evans,

In S3, the author is referring to specific surveys, so *the* is obligatory.

Going back to S1, another general grammatical feature of English is that if you have the following sequence of words: *noun1 + of + noun2*, then noun1 is preceded by *the*. This is because noun1 is used to specify noun2. This means that we need *the* before *importance* and before *design*.

The last noun in S1 is countable but it is plural (*systems*) and unspecified (we know that the systems are *internal*, but we do not know which *internal systems* they are). In such cases, no article is required.

No *the* is required for uncountable nouns (i.e. *lack, feedback* and *equipment* in S4–S6).

S4. Lack of protective immunity against reinfection with hepatitis C virus

S5. Feedback and optimal sensitivity

S6. Vibration analysis for electronic equipment

There are some cases where the use or non-use of *the* changes the meaning of the title.

S7. The factors that determine depression

S8. Factors that determine depression

S7 gives the idea that the author has made a comprehensive survey of depression and has identified all those factors that lead to depression. This makes the paper sound like the final word on depression, i.e. this is the definitive article on depression.

S8 is not all-inclusive. The reader will expect to learn about some factors. This makes the paper sound much more modest.

Sometimes the use of *the* does not follow the same rules as in general English. For example, the first word in S9–S11 is a countable noun in the singular and as such would normally require *the*.

S9. Effect of clinical guidelines on medical practice
S10. Influence of education and occupation on the incidence of Alzheimer's disease
S11. Association of exogenous estrogen and endometrial carcinoma
S12. Measurement of protein using bicinchoninic acid

Such non-use of *the* seems to be very common in medicine, biology and chemistry. S9 and S10 could also be written as *The effect of* ... and *The influence of* with no change in meaning.

Given that the rules of the use of *the* are rather mysterious, the best thing to do is to use Google Scholar to compare your draft title with similar titles. For more explanations of the usage of article see Sect. 6.6.

11.15 How do I know whether to use *a* or *an*?

The difference between *a* and *an* in a title follows normal usage.

Use *a* before all consonants, before *eu*, and before *u* when *u* has the sound as in *university* and *unit*.

Use *an* before *a, i* and *o*. It should also be used before *e* except before *eu*, and before *u* when *u* has the sound as in *unusual* and *understanding*. Use *an* before *h* only in the following cases: *hour, honest, honor, heir*. Some authors use *an* before *historical* too.

These rules mean that the following are wrong:

S1. *An hybrid approach to X.
S2. *An unique approach to Y.

S1 should be *a hybrid* (the *h* in *hybrid* is aspirated). S2 should be *a unique*, because the *u* in *unique* is pronounced like *you*.

Note also the words in italics in the following italics:

S3. GNRA tetraloops make *a U-turn*
S4. The evacuation of the Machault, *an 18th-century* French frigate
S5. *An NLP* application with a multi-paradigm architecture

u as a separate letter is pronounced *you*, *18th* stands for *eighteenth* (i.e. beginning with an *e*), and *N* is pronounced *en*.

11.16 Is using an automatic spell check enough?

No, it isn't! The following titles contain spelling mistakes and typos (e.g. inverted or missing letters) that spell checkers are not able to find.

S1. *Incidence of Hearth Attacks and Alzeimer's Disease among Women form East Asia

S2. *An atmospheric tape reorder: rainfall analysis trough sequence weighing

In S1 there are two errors that a spell checker cannot find - *hearth* and *form* (*heart* and *from*). This is because these words exist and will be in the spell checker's vocabulary. Likewise in S2 *reorder, trough* and *weighing* (*recorder, through* and *weighting*) are words that exist.

A spell checker would certainly highlight *Alzeimer's* (S1) as not being correct, but many authors ignore technical words that are highlighted by mistakenly thinking that they are simply not in the spell checker's vocabulary. Often this is the case, but not here. The correct spelling is *Alzheimer's*.

The problem in this case is that you as the author may be incredibly familiar with the title of your paper, it may even have been the title of your Masters or PhD thesis. This means that you are unlikely to check for possible errors. Given that you may not be unable to see your own spelling mistakes, it is a good idea to show your title to several other people, firstly to get them to check the spelling but more importantly to get some feedback on whether your title is clear and explicit enough.

In a research paper, poor spelling gives the idea that you did not make the effort to check your paper. By extension, if you did not check your spelling there is a chance you did not check your data. Perhaps for this reason referees seem obsessed with finding and reporting spelling mistakes. If they find more than one or two this may cause them to recommend that publication of your paper should be delayed until the paper has been thoroughly proof read.

Another major reason for checking the spelling in your title, is that if a key word (e.g. Alzheimer's) is misspelled or not punctuated correctly (note the apostrophe before the *s*), then search engines will not be able to find it.

Here are the returns (in rounded numbers) from Google Scholar for *Alzheimer's*, *Mediterranean*, and *silicon wafer*. The first two rows contain misspellings, the correct version is in the last row.

Alzeimers	1	Meditterranean	15	silicon waffer	5
Alzheimers	1,490	Mediterranean	24	sillicon wafer	11
Alzheimer's	100,000	Mediterranean	13,300	silicon wafer	175,000

These numbers prove the importance of spelling key words correctly to ensure that potential readers find your paper.

11.17 Summary: How can I assess the quality of my title?

- You need to check that your title is:
  - in correct English - in terms of syntax, vocabulary, spelling and capitalization
  - understandable (no strings of nouns)
  - eye-catching and dynamic (through effective use of vocabulary and even punctuation)
  - sufficiently and appropriately specific
  - reflects the content of your paper
  - expressed in a form that is acceptable for a journal
- You can check the syntax and the level of understandability by consulting with a native speaker. Generally speaking titles that contain at least one verb and one or more prepositions tend to be much easier to understand.
- You can check the vocabulary and spelling using Google Scholar. Remember that an automatic spell check is not enough.
- The best way to decide whether it is eye-catching and sufficiently specific is to prepare several titles (including ones in two parts, and in the form of a question) with various levels of specificity and ask colleagues to choose their favorite.
- Unless you get someone to read the whole paper for you, you are probably the best judge of whether your title reflects the actual content of your paper. If it doesn't, the referees will probably tell you.

Chapter 12
Abstracts

What key skills are needed when writing an Abstract?

The key skills are to write an Abstract in a way that will enable:

- editors to make a quick decision on whether the paper is relevant to their journal (without having to read the whole paper) and is thus worth submitting to referees who will then judge the paper in its entirety
- a reader to identify quickly what the paper is about, to judge how relevant it is to their interests, and so to decide whether they should buy / read the whole paper or not. This process is sometimes known as 'screening'
- information managers (e.g. librarians) to put it in their indexes

Online journals have databases of abstracts. Your job as a writer is to 'sell' your abstract to potential readers by:

- attracting their curiosity and stimulating them to want to read the complete paper
- writing very clear and short sentences (max. 25 words, unless the sentence contains a list)

First impressions are very important. If your paper makes a bad initial impression, there is a very strong chance that the reader will quickly stop reading. It will also have a negative effect on referees - if they struggle to read your Abstract or Introduction, this will impact on their reading of the rest of the paper. They will expect the rest of the paper to be difficult too, and may only to look for evidence that confirms this initial impression, even if the rest of the paper is in fact quite readable.

A. Wallwork, *English for Writing Research Papers*,
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Typical complaints of referees

The author has written more than 400 words in the abstract and yet has only described the context but not the results of his/her work and the implications.

The abstract doesn't do justice to what the paper is about. It is too abstruse and dense. It is only understandable after the paper has been read. It should be understandable to a general economics-literate audience, not just to those few researchers within the author's very specific field.

The authors have failed to state why the scientific community should be interested in their work nor what value is being added to what is already known.

12.1 What is an abstract? How long should it be?

There are four main types of abstracts, all of which summarize the highlights of your research and all of which will be judged in isolation from the accompanying paper (if there is one). Abstracts are sometimes called Summaries.

Abstracts are found before a full article in a journal, standalone in databases of abstracts, and in conference programs.

UNSTRUCTURED ABSTRACT

A single paragraph of between 100–250 words containing a very brief summary of each of the main sections of your paper

STRUCTURED ABSTRACT

The same as (1) but divided into several short sections (Sect. 12.11).

EXTENDED ABSTRACT

A mini paper organized in the same way as a full paper (e.g. Introduction, Methods, Discussion …), but substantially shorter (two to four pages). Depending on the journal, conference or competition, the extended abstract may or may not include an abstract – for example, it may begin directly with an introduction

CONFERENCE ABSTRACT

Normally a standalone abstract (sometimes up to 500 words), designed to help conference organizers to decide whether they would like you to make an oral presentation at their conference (Sect. 12.13). It may be of any of the three forms above.

The type of abstract you choose and the format to use will depend on the journal or conference. Make sure you read their instructions to authors before you begin writing.

12.2 When should I write the Abstract?

Write a rough draft of the abstract before you start writing the paper itself. This may help you to decide what to include in the paper and how to structure it. But experienced writers always write the Abstract (and often the Introduction too) last, i.e. when they have finished the rest of the paper. This reflects the research process itself - the first thing you write about is what you found, then how this can be interpreted.

In any case, and as with the whole paper, you must have a clear idea of your intended audience.

12.3 How should I structure my Abstract?

An Abstract generally answers at least the first three of the following questions, and generally in the following order. You can use the answers to these questions to structure your Abstract.

- Why did I carry out this project? Why am I writing this paper?
- What did I do, and how?
- What were my results? What was new compared to previous research?
- What are the implications of my findings? What are my conclusions and/or recommendations?

However chemists, physicists, biologists etc. who are presenting some new instrumentation may want to focus not on what they found, but on what the benefits of their apparatus are and how well it performs.

To decide what to include it may help you to go through your paper and highlight what you consider to be the most important points in each section.

The order in which you answer the questions above can make a very different impression on readers. To learn more about this important aspect see Sect. 4.6.

12.4 Formal, natural and applied sciences. How should I structure my abstract? How much background information?

Although the style of an abstract may differ from discipline to discipline and from journal to journal, the structure and information provided is quite similar. The aim is always to tell readers all they need to know to help them decide whether to buy / read the paper.

Below is a fictitious example from an applied science - engineering - and would also be applicable for most formal sciences and natural sciences (as defined by Wikipedia - http://en.wikipedia.org/wiki/Science). The numbering is mine.

> (1) The lifetime of a 4G cellular phone battery may be subject to the number of times the battery is recharged and how long it is charged for. To date, there has not been an adequate analytical model to predict this lifetime. (2) In this work an analytical model is developed which describes the relationship between the number of times a battery is recharged, the length of time of each individual recharge, and the duration of the battery. (3) This model has been validated by comparison with both experimental measurements and finite element analyses, and shows strong agreement for all three parameters. (4) The results for the proposed model are more accurate than results for previous analytical models reported in the literature for 4G cell phones. (5) The new model can be used to design longer lasting batteries.

Below is the structure of the above abstract and the questions it aims to answer. The numbers refer to the numbers in the abstract.

1. The problem that this paper is trying to resolve set in the context of the current situation. Why did you carry out your project and why are you writing this paper? What gap in the current knowledge do you hope to fill?
2. New solution given by authors of the paper. What is the innovative contribution of your work? What did you do and achieve? What makes it different from previous research?
3. Validity of the model. Does it really do what you say it does?
4. Results. What is new compared to previous results?
5. Implications and future work. What does this all mean? What are your conclusions and recommendations? What do you plan to do next?

This abstract only has a minimal amount of background information (two lines). This background information is given so that reader can understand the context of the author's research.

Context setting should never take up more than 25% of the whole abstract, as it probably contains information that the reader already knows. Your readers want new information, not old information. Remember that the reader may be a referee who has to read hundreds of abstracts to decide which to include for a conference or in a journal. He / She wants to know immediately what the topic is and will be negatively affected if forced to wait several lines before understanding this. Of course, you can (and should) give more background details in the Introduction.

12.5 Social and behavioral sciences. How should I structure my abstract? How much background information?

Here is an abstract from a fictitious paper entitled *Is it Time to Leave Him?* written by one of my PhD students, Estrella Garcia Gonzalez from Madrid. By *sitting-zapping sessions* she means sitting like a zombie in front of the television and constantly changing channels.

> (1) Three red flags were identified that indicate that the time to leave him has come. These red flags are: five burps per day, two sitting-zapping sessions per day, and fives games on the Playstation with friends per week. (2) A large number of women have doubts about the right moment for leaving their partner. Often women wait in hope for a change in their partner's habits. (3) One hundred couples were analyzed, recording their daily life for six months. Women were provided with a form to mark the moments of annoyance recorded during the day. Burps, sitting-zapping sessions and games on the Playstation with friends produced the highest index of annoyance. (4) The probability of eliminating these habits was found to be significantly low when the three red flags had been operative for more than three months. (5) Thus, these numbers provide a good indication of when the time to leave him has come. With these red flags, women will no longer have to waste their time waiting for the right moment.

Below is a series of instructions for writing an abstract based on Estrella's structure. Again, the numbers refer to the numbers in the abstract.

1. Begin the abstract with one or two sentences saying what you did plus one key result, i.e. begin with information that the reader does NOT already know
2. Introduce the background by connecting in some way to what you said in your introductory sentence. The concept of leaving him is introduced in (1) and then referred to again in (2)
3. Use the background information (which the reader may or not already know) to justify what you did, and outline your methodology (and materials where appropriate)
4. Provide some more information on your results
5. Tell the reader the implications of your results

12.6 I am a historian. We don't necessarily get 'results' or follow a specific methodology. What should I do?

If you analyze history abstracts, and other abstracts from humanistic disciplines, they still have a structure that is similar to a scientific abstract.

You have a primary objective (e.g. a theory or perspective that you would like to share, test, analyze or question), a design to your research, some methods and procedures that you used, some outcomes from your research that support your theory / perspective, and some conclusions or implications derived from these outcomes.

Abstracts from social and behavioral sciences tend to devote more space to background issues and context setting. The 'thesis' is often formulated as a series of questions that inform the reader about what issues will be dealt with in the paper.

In any case your abstract should include the following:

- background information
- your aim and its importance
- your contribution and its value
- what you looked at
- your conclusions and implications

Here is a fictitious abstract from a researcher interested in the history and evolution of languages.

> (1) The Quaker movement was founded in the mid 17th century by George Fox. One of the practices used by this rebellious religious group was the use of 'plain speech' and

> ‘simplicity’. This involved addressing all people with the same second person pronoun, in the words of Fox: ‘without any respect to rich or poor, great or small’. The modern use of ‘you’ in the English language (in the 10th century England there were 12 forms of ‘you’) is thus attributed to Fox’s egalitarian movement. (2) Was this use of ‘you’ for addressing all kinds of people, regardless of their social status, specifically initiated by Fox? Or was it simply a part of an organic unplanned process in the English language of ridding itself of unnecessary devices and formalities? Are some languages more dynamic than others? And does this depend on how ‘controlled’ they are by official prescriptions? (3) By analyzing 50 English texts from 1012 to 2012, I show that English has successfully eliminated all accents on words, simplified punctuation use, virtually made the subjunctive redundant, and reduced the average sentence length by more than half from around 35 in the convoluted style of the 18th century to 14 words today. (4) Our findings show that English has the potential for being democratic, concise yet profound, and simple to understand. (5) I believe that this has implications for those languages, such as French, Italian, Korean and Turkish, that have conservative academies for safeguarding the ‘purity’ of their language.

The above abstract covers the following elements, which typically appear in humanistic abstracts. The numbers below refer to the numbers in the abstract.

1. Background information - there tends to be more context setting in humanistic than in scientific abstracts, and this may take up even 50% of the text
2. Gap in the knowledge - here the author challenges the accepted view on the topic. Using the question format, the author tells the reader what areas of the topic he plans to address. Questions create variety in an abstract and give it added interest
3. Methodology and results - the author provides some brief information on the data he used to get his findings
4. Conclusions
5. Implications - having implications in some way justifies why the author did his work, it gives the work relevance, it shows that the work makes a real contribution and was not just carried out for the author’s own personal interest

12.7 I am writing a review. How should I structure my Abstract?

As with all abstracts of all disciplines, when you are writing a review you need to tell audience what your primary objective is. Given that you will not have space to review every paper in the literature, you should then explain your reasons for selecting certain papers. Your ‘results’ are your findings drawn from analyzing the literature. Finally, for your review to have a real purpose you will want to state your conclusions and what implications they have for further research in your field.

So once again your structure is: aim, methodology (selection process), results, conclusions, and implications.

12.8 How should I begin my Abstract?

When you read an advertisement for a product it never begins *The objective of this advertisement is to convince you to buy …* Instead advertisers go straight to the point. Abstracts are like advertisements for your paper.

You want your abstract to stand out so that there will be a better chance someone will notice it and read it. If you begin your abstract with commonly used phrases (by both native and non native English speakers) such as *This paper deals with … The aim of this paper … This article explores … We report …* you are not differentiating yourself from the others. In fact, some journals advise against using such expressions.

Below are some examples taken from abstracts in very different fields.

	ORIGINAL VERSIONS (OV)	REVISED VERSIONS (RV)
1	In this paper we present the design and development of a *highly innovative* software application //, Transpeach, which allows *mobile phone users* to use their own native language when speaking to someone of another native language. The prototype version enables a Japanese mobile phone user …	To extend automatic translation from written to oral communication we developed Transpeach. This software allows, for instance, a *Japanese mobile phone* user to talk to a Greek counterpart in Greek, likewise the Greek's words are automatically translated into Japanese.
2	We present a procedure for the analysis of the content of // organic materials present in archeological samples. The procedure allows the identification of a *wide variety* of materials within the same micro sample.	Archeological samples used for identifying organic materials are by necessity extremely small. We have found a way, which *we believe* is the first of its kind, to accurately identify *glycerolipids, natural waxes, proteinaceous, resinous and polysaccharide* materials within the same micro sample.
3	In this article we conduct an exploration of the crucial of role of the // invention of the steam engine in the Industrial Revolution, and specifically the modified version created by James Watt, the Scottish inventor born in 1736. However, *we contend that the merit* for the success of the steam engine should be …	James Watt's modified steam engine is widely acknowledged as paving the road to the Industrial Revolution. But was this Scottish inventor really the brains behind the steam engine? We *contend that Henry Wallwork*, a little-known Mancunian foundry entrepreneur, should be given more credit for …

In the OVs readers have to wait up to 15 words (i.e. until //) before reaching a key word that enables them to understand the potential relevance of the topic. They have to read words and expressions that they have read thousands of time before and which add absolutely no value to the abstract. In the RVs, the reader

learns either immediately or very quickly what the author has done to fill the knowledge gap.

RV1: In the first sentence the author manages to combine both the background (automatic written translation) with the new information (automatic oral translation). The words *highly innovative* have been removed. More concrete examples are given, which reflect what the prototype does.

RV2: The abstract now begins with *archeological samples*, so that the reader can immediately understand the general topic of the paper. The vague phrase *a wide variety of materials* has been replaced with concrete examples of these materials. This makes the RV slightly longer than the OV, but it now has a much stronger impact.

RV3: The abstract now gets straight to the point without the initial redundancy of the OV. The OV contains a detail - the birth date of James Watt - that serves no purpose for the reader and has thus been removed in the RV.

Going back to RV1, rather than telling your readers that what you have done is *highly innovative*, it might be more effective if you demonstrate the innovation element so clearly that readers reach this conclusion by themselves. This does not mean you always have to be modest about your achievements. In fact in RV2 the phrase *which we believe is the first of its kind* has been added to draw the reader's attention the contribution of the paper. The term *highly innovative* is subjective, *first of its kind* is informative.

12.9 What style should I use: personal or impersonal?

There are four possible styles for writing abstracts and papers:

STYLE 1	I found that x = y.
STYLE 2	We found that x = y.
STYLE 3	It was found that x = y.
STYLE 4	The authors found that x = y.

The style you use will depend on your discipline and on the requirements of the journal. Using the first person singular (Style 1), is generally only found in humanistic fields where the author's opinions are often outlined. Here is an example - an abstract from a paper (Sect. 10.2) entitled *International scientific English: Some thoughts on science, language and ownership.*

STYLE 1 The intention of this paper is to raise some questions about the 'ownership' of scientific English. Its author is a native speaker of English and a teacher of scientific English, but it aims its arguments at the international scientific community communicating in English. The paper is deliberately somewhat provocative in parts in an attempt to raise some questions about 'scientific English' which *I think* are important but which have not been faced to date.

Style 2 is found in all fields. Here is an example of the beginning of an abstract from a physics paper entitled *Tumbling toast, Murphy's Law and the fundamental constants*.

> STYLE 2 *We investigate* the dynamics of toast tumbling from a table to the floor. Popular opinion is that the final state is usually butter-side down, and constitutes prima facie evidence of Murphy's Law ('If it can go wrong, it will'). The orthodox view, in contrast, is that the phenomenon is essentially random, with a 50 / 50 split of possible outcomes. *We show* that toast does indeed have an inherent tendency to land butter-side down for a wide range of conditions.
>
> [to tumble = to fall and turn; butter-side down = people in Britain often put butter on one side of their toast]

Style 3 is also very common and many journals insist on this style. For an example of this style see the abstract in Sect. 12.5.

Style 4 is the least common style. Here is an example of the beginning of an abstract from a fascinating psychology paper entitled *Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments*

> STYLE 4 People tend to hold overly favorable views of their abilities in many social and intellectual domains. *The authors* suggest that this overestimation occurs, in part, because people who are unskilled in these domains suffer a dual burden: Not only do these people reach erroneous conclusions and make unfortunate choices, but their incompetence robs them of the metacognitive ability to realize it. Across 4 studies, the authors found that …

For links to these papers see page 311.

12.10 What tenses should I use?

The most commonly used tenses in abstracts are the PRESENT SIMPLE (*we show*) and the PAST SIMPLE (*we showed*).

The author of the "tumbling toast" abstract (Style 2) uses the PRESENT SIMPLE to:

- describe the contents of his paper (*we investigate, we show*).
- describe the common opinion that he is trying to question (*the phenomenon is essentially random*)
- refer to what he did during his experiments (*We show that toast does indeed have an inherent tendency*)
- give his conclusions - not shown here - (*Murphy's Law appears to be an ineluctable feature of our universe*)

In fact he uses only the PRESENT SIMPLE. Even though his research has already been done (thus the investigation is complete), he uses the PRESENT SIMPLE

because he wants to make his abstract sound more dynamic and his conclusions more convincing. However, in the paper itself he uses the PAST SIMPLE to describe what he did and found.

In the "incompetence" abstract (Style 4), the authors use the PRESENT SIMPLE to:

- talk about a well-known situation (*people tend to hold overly favorable views*)
- explain their opinion on this well-known situation (*the authors suggest that …*)

They then use the PAST SIMPLE to describe what they did / achieved and what conclusions they reached (*the authors found that ..*). This is the standard way to use tenses in abstracts.

The author of the "scientific English" abstract (Style 1) ends his abstract by using the PRESENT PERFECT (*which have not been faced to date*). You can use the PRESENT PERFECT and the PRESENT PERFECT CONTINUOUS when you describe a situation that began in the past and is still true now. This is typical when you are giving the context / background.

> In the last few years there *has been* considerable interest in …
>
> Since 2010 attention *has focused* on …
>
> To date, there *has not been* an adequate analytical model …
>
> For more than a decade data analysts *have been developing* new ways to …

Note: the underlined parts highlight the past-to-present timeframe. For example, *in the last few years* means a situation or action that began a few years ago and is still true today. *To date* means so far in the history of this particular branch of study.

Some authors also use the PRESENT PERFECT (in the active or passive) to describe what they achieved during their research.

> We *have found / devised / developed* a new approach to X. We *have demonstrated / proved / validated* the effectiveness of this approach by …
>
> A new approach to X *has been devised.* The effectiveness of the approach *has been demonstrated* …

12.11 How do I write a structured abstract?

Structured abstracts, which look like mini-papers, are becoming more and more popular. They are typically found in medicine, but also in economics, natural sciences and other areas. Most authors agree that the structured format helps them to write clearer abstracts. Structured abstracts also force the author to answer all the

questions (including limitations to their research) that referees and readers are likely to ask.

In addition, they are much more readable as referees (for their peer reviews) and readers can find exactly what they want quickly.

As with all abstracts, it is very important that you follow the journal's instructions to authors which will tell you what sections to include in your abstract and what style to adopt.

This sort of abstract tends to be longer (up to 400 words) and is often written as a series of points, though full sentences with verbs are always used in the Results and Conclusions.

Here are some typical sections in a structured abstract:

From a journal of vegetation sciences:

> Question - Location - Methods - Results - Conclusions

From an economics journal:

> Purpose - Design / Methodology / Approach - Findings - Practical implications - Originality / value - Keywords - Paper type

From various medical journals:

> Background / Context / Purpose - Methods - Results / Findings - Conclusions
>
> Context - Aim / Objective - Design - Setting - Patients (or Participants) - Interventions / Treatment - Main Outcome Measure(s) - Results - Conclusions
>
> Context - Objective - Data Sources - Study Selection - Data Extraction - Results - Conclusions

Other sections sometimes found include: Level of evidence, Clinical relevance, Data collection / Extraction methods.

See page 314 (20.4) for a link to an example of a structured abstract that has important implications for non-native researchers.

12.12 How do I write an abstract for a conference?

An abstract for a journal has to be relevant to the specialization of that journal. Likewise, an abstract for a conference must *really* fit the conference theme. This point is absolutely essential. Occasionally in the rush to organize the conference the editorial board may initially accept your abstract on the basis that it sounds interesting. Then a few months later when you send them your full version, the editors may realize that it does not actually fit the theme. So if it doesn't fit, choose another conference.

Try to ensure that your abstract will not just be enticing for the editorial board but also that it will be suitable for publishing in the conference handbook / proceedings. Your title should be interesting but not too obscure or too colloquial / witty. It can be less 'technical' than a title for a journal, and many often contain two parts (Sect. 11.5) - the first part is technical, and the second part contains a more informal interpretation of the first part. Or vice versa - the first part is more fun, and the second more serious.

If the conference that you plan to go to is not in its first edition, you can look at abstracts from the previous editions to see their style and tone. In any case, the rules for writing the abstract itself are the same as for a journal, though your style may be slightly more informal.

12.13 How do I write an abstract for a work in progress that will be presented at a conference?

Conferences are generally planned up to two years in advance. When you answer the call for papers, your research may not yet be complete, but nevertheless you think that the conference would be a good way to get feedback on your progress. Below is the first draft of an abstract on how students choose the topic for their doctorate. It was written for a conference by Rossella Borri, an Italian PhD student in Political Sciences, whose research at the time of writing the abstract was only in its initial stages. Her initial draft, below, was not suitable for a conference - it is misleading because it is still a work in progress, which is not apparent from the draft.

> With its focus on the research cycle, scientific methodology has devoted a great deal of attention to the phase of problem solving. However, the issue of problem choice has been relatively neglected, notwithstanding its relevant epistemological implications. What are the criteria used by PhD students to set their research agenda? To what extent is the research agenda driven by pure curiosity about social phenomena? How much is it a matter of bargaining with various resource limitations? A survey was carried out among PhD students of European universities to examine the criteria used in the choice of their dissertation topics. The analysis sheds light on the way scientific knowledge is crafted, and about the challenges and limitations researchers face during this process.

The abstract would be fine if she had finished her research - which is what most readers would understand. The problem is that it gives no idea of the fact that the research is only at the beginning and that the data from the survey have as yet not been analyzed. It is thus rather misleading and those who go to her presentation at the conference might be very disappointed not to hear the concrete results that the abstract seems to promise. Having shown her abstract to her tutor who warned her of such a possible misinterpretation, Rossella then revised the second part of the abstract by saying:

> We are *currently* carrying out a survey of 500 PhD students of European universities to examine the criteria employed in the choice of their dissertation topics. Analysis of the data

> *will explore* the relationship between factors such as the duration of the PhD programme, the availability of a scholarship or background experience in the field and PhD students' criteria for choosing the specific issue that they wish to study. Initial results from the first 20 surveys *seem to indicate* the importance of the availability of funding and the potential job prospects rather than preferences driven by pure interest for its own sake. We *hope* to shed light on the way scientific knowledge is crafted and about challenges and limitations young researchers face during this process.

The abstract now contains the words *currently, will explore, seem to indicate*, and *we hope*, all of which highlight that this is ongoing research. By adding some of the initial results, the audience at the conference will be interested to know whether these results were confirmed when the whole battery of surveys was analyzed.

Your abstract should encourage conference attendees to come and hear you rather than going to a parallel session. If you don't have any results at all, you should either consider going to a later conference when you have something more conclusive to say, or tell readers what you expect your results to show.

12.14 How should I select my key words? How often should I repeat them?

There is a lot of mystery around how Google and other search engines use key words when indexing websites and articles. In any case it makes sense to have key words in your abstract (and title too) because it forces you, the author, to decide what words in your paper really are important. The key words are also the words that readers are looking for in their initial search and then when they actually scan your abstract. General consensus seems to be to not repeat the key words more than three times in the abstract. This can be tedious for the reader. More importantly, 'keyword spamming' may lead to the web page being rejected by the search engine.

Some journals require you to have a list of four or five key words directly under your abstract. The same journals may also require that the keywords in this list should not appear in the text of the abstract.

Make sure you have a very clear idea of the policy regarding key words of the journal or conference before submitting your abstract.

12.15 Should I mention any limitations in my research?

You should certainly mention the limitations of your research at some point in the paper. However, given that an Abstract is designed to 'sell' your research, you might decide not to mention the limitations until the Discussion (Sect. 17.11).

12.16 What should I not mention in my Abstract?

You should try to avoid:

- background information that is too generalist for your readers
- claims that are not supported in the paper
- terms that are too technical or too generic - this will depend on your audience
- definitions of key terms
- mathematical equations
- generic quantifications (e.g. *many, several, few, a wide variety*) and the overuse or unjustified use of subjective adjectives (e.g. *innovative, interesting, fundamental*).
- unnecessary details that would be better located in your Introduction, such as the name of your institute, place names that readers will not have heard of
- references to other papers. However, if your whole paper is based on an extending or refuting a finding given by one specific author, then you will need to mention this author's name.

12.17 How can I ensure that my Abstract has maximum impact?

There are three main ways to do this. Firstly, put the information in the best possible order. Secondly, highlight the importance of what you are saying. And thirdly, be as concise as possible. To see full examples of how to do this, see Sects. 4.6 (putting info in best order), 8.9 (highlighting), and 5.15 (being concise).

12.18 What are some of the typical characteristics of poor abstracts?

The following abstract, from a fictitious paper entitled *An innovative methodology for teaching English pronunciation,* has a series of problems.

> The English language is characterized by a high level of irregularity in spelling and pronunciation. A computer analysis of 17,000 English words showed that 84% were spelt in accordance with a regular pattern, and only 3% were completely unpredictable [Hanna et al., 1966]. An example of unpredictability can be found in English numbers, for example, *one, two* and *eight*. Interestingly, English spelling a thousand years ago was much more regular and almost phonetic. Words that today have a similar spelling but radically different pronunciation, such as *enough, though, cough, bough* and *thorough*, once had different spellings and much more phonetic pronunciations. In this paper, a pioneering method, developed by the English For Academics Institute in Pisa (Italy), of teaching non-native speakers how to quickly learn English pronunciation is presented and discussed.

The problems are:

- it is not self sufficient. If readers read this abstract in isolation from the paper, they would have no idea about what the author actually did in his / her research, nor what was found
- it looks like the beginning of an Introduction not an Abstract. Apart from the last line it is all background information. This information is interesting and relevant to the topic of the paper. But it is not new information. Basically, it tells the reader nothing about what contribution the author has made to this field of study
- it contains a reference to another authors work, Hanna. This is not common in an Abstract
- it mentions irrelevant details. In an abstract the reader does not really need to know where the research was carried out, particularly in this case where the exact location of the research (Pisa, Italy) is totally irrelevant - it has no impact on the findings
- the pioneering method is not described, nor do we have any idea about why it is 'pioneering'
- the reader has no idea of what results were obtained

The result is that readers in this field - English pronunciation - are likely to skip this article and move on to the next one they find. A better version of the abstract would be:

> We have developed a didactic method for addressing the high level of irregularity in spelling and pronunciation. We combine new words, or words that non-native speakers regularly have difficult in pronouncing, with words that they are familiar with. For example, most adult learns have few problems in pronouncing *go, two, off* and *stuff* but may have difficulties with *though, cough* and *rough*. Through associations - *go / though, two / through, off / cough, stuff / tough* - learners can understand that familiar and unfamiliar words may have a similar pronunciation and can thus practice pronouncing them without the aid of a teacher. Tests were conducted on 2041 adults selected at random from higher education institutes in 22 countries and incorporating five different language families. The results revealed that as many as 85% of subjects managed to unlearn their erroneous pronunciation, with only 5% making no progress at all. We believe our findings could have a profound impact on the way English pronunciation is taught around the world.

The revised version is better because:

- readers are immediately told what the author did. There is no background information because the context is well known
- the methodology is explained and a concrete example is given
- the selection process of the subjects (*adults*) is described
- the results are given
- numbers are qualified (*as many as* 85%, *only* 5%) to help readers understand whether the numbers reflect normal expectations, or are particularly high or low
- the implications are stated
- the word 'pioneering' is avoided - it is left to the reader to decide if the method is pioneering or not

The result is that readers in this field are more likely to be stimulated into reading the rest of the article.

12.19 Summary: How can I assess the quality of my Abstract?

To make a self-assessment of your Abstract, you can ask yourself the following questions.

- Have I followed the journal's instructions to authors? Have I followed the right structure (i.e. structured, unstructured) and style (*we* vs passive)?
- Have I covered the relevant points from those below?
  - background / context
  - research problem / aim - the gap I plan to fill
  - methods
  - results
  - implications and/or conclusions
- Have I chosen my keywords carefully so that readers can locate my Abstract?
- Whenever I have given my readers information, will it be 100% clear to them why they are being given this information? (You know why, but they don't.)
- Can I make my Abstract less redundant? If I tried to reduce it by 25% would I really lose any key content?
- Have I used tenses correctly? PRESENT SIMPLE (established knowledge), PRESENT PERFECT (past to present background information), PAST SIMPLE (my contribution)

Chapter 13
Introduction

What key skills are needed when writing an Introduction?

The Introduction presents the background knowledge that readers need so that they can appreciate how the findings of the paper are an advance on current knowledge in the field. A key skill is to be able to say the same things that have been said many times before but in a different, interesting, intriguing way.

You have to give the reader the tools for understanding the meaning and motivation of your experiments.

Tell your readers how you plan to develop your topic. Give them a roadmap to follow - show them what your line of argument is.

You need to have a deep knowledge about everything that has been previously written on the topic and decide what is important for the reader to know.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_13, © Springer Science+Business Media, LLC 2011

Typical complaints of referees

The Introduction occupies too high a proportion of the entire paper and contains too many general statements that are already widely known. The rationale and objectives are not defined and the whole section is completely disorganized - it is not clear what problem the author is addressing or trying to solve and why they chose their particular methodology. Much of the initial part is essentially a cut and paste from the Abstract.

The author has not related the background information to the objective of the paper. Also, there is no mention of what the reader can expect in the rest of the paper (i.e. main results and conclusions) and how this information will be structured (i.e. into the various sections).

Please remember that the paper may be read by inexperienced Ph.D. students or others starting their work in your specific field. Hence, please add an explanation or at least a reference when mentioning notions related to … and the terminology for ...

13.1 How should I structure the Introduction?

An Introduction generally answers the following questions. You can use the answers to these questions to structure your Introduction.

- What is the problem?
- Are there any existing solutions (i.e. in the literature)?
- Which solution is the best?
- What is its main limitation? (i.e. What gap am I hoping to fill?)
- What do I hope to achieve?
- Have I achieved what I set out to do?

13.2 How should I begin my Introduction?

Below and in Sect. 13.3 is an example of the structure of a typical Introduction. It consists of a sequence of ten parts, each with a specific role. Your Introduction will not necessarily include all ten parts nor sequence them in the same order.

Your aim is to include only enough background information to allow your reader to understand why you are asking the questions you are, in what context they appear, and why your hypotheses, predictions or expected results are reasonable. It is like a preview to the rest of the paper. Thus nearly every Introduction, irrespectively of the discipline, would incorporate those parts marked with an asterisk (*).

The proportion of space given to each part (particularly with regard to the review of the literature) will obviously vary from discipline to discipline, and from paper to paper.

You could begin with one or more of the first four parts listed below.

	FUNCTION	AUTHOR'S TEXT
1	definition of the topic plus background	An XYZ battery is a battery that ... The electrodes in an XYZ telephone battery are made of a composite of gold and silver, coated with a layer of platinum. The gold and silver provide structural support, while the platinum provides resilience.
2	accepted state of the art plus problem to be resolved	The performance of the battery can be strongly affected by the number of times the battery is recharged and the duration of each individual recharge. The battery is subject to three possible failure modes. ...
3	authors' objectives	A research program has recently been started by the authors in collaboration with a major battery manufacturer, with the goal of developing new design models for XYZ batteries. Analytical techniques are needed that can predict ...
4	introduction to the literature	Computational techniques have been extensively applied to the study of the lifetime of XYZ batteries, in particular with regard to the number of times a battery is charged. However, little research to date has focused on the length of each individual recharge.

Below is an analysis of Parts 1–4 of the Introduction. In brackets is a very approximate indication of how many sentences you will probably need for each part.

PART 1 DEFINITION OF THE TOPIC PLUS BACKGROUND (1–3)

This introductory phrase may not be necessary in your paper. Here the definition of the XYZ battery indicates to the reader that this is the background topic (i.e. the general context) of the paper. This is the place to include notations, technical definitions, and explanations of key words.

The second sentence gives information that readers should already be familiar with and suggests why the topic is important and of interest. It will help readers to understand why you are investigating this area and how you hope to extend the knowledge. It sets the context for the information that will follow in (3), which may be less familiar for your readers. Readers want to quickly learn what the specific topic of your research is, they are much less interested in being reminded how important the general area of research is.

PART 2 ACCEPTED STATE OF THE ART PLUS PROBLEM TO BE RESOLVED (2–4)*

In the example text, XYZ batteries is the general context. The authors now move from this general context to the specific area of their research: XYZ batteries in telephones, and more specifically, the problems inherent in such batteries. This is the gap that the authors want to fill and that the readers should be most interested in. This part should state in simple and clear language exactly what the problem is, why you chose it, why you claim it is important.

PART 3 AUTHORS' OBJECTIVES (1–2)*

Here the authors outline their major objectives, i.e. how they intend to fill the gap. Parts 6 and 7 (see next page) could be incorporated here. This part also serves as a transition into the review of the literature.

PART 4 INTRODUCTION TO THE LITERATURE

This introduces the background literature that the authors intend to refer to in order to motivate their particular research. It makes a reference to current insufficient knowledge of the topic.

This may be in a separate section with its own heading (Review of the Literature – see Chap. 14), or after the Results in a clinical paper, or incorporated into the Discussion.

13.3 How should I structure the rest of the Introduction?

The Introduction outlined the previous subsection continues as follows:

	FUNCTION	AUTHOR'S TEXT
5	survey of pertinent literature	More recent research has occurred in the field of laptop and jPud batteries. Evans [15] studied the lifetime in 5G jPud batteries. Smith [16] and Jones [18] found that ... However their findings failed to account for ...
6	authors' contribution	To the best of our knowledge there are no results in the literature regarding how the length of each recharge impacts on the silver and gold in the electrodes.
7	aim of the present work	The aim of the present work is to construct a model to perform a comprehensive investigation of the effect of recharging on the electrodes, and to find a new proportion in the amount of metals used. The assumptions of Smith [16] and Jones [18] are used as a starting point. ...
8	main results / conclusions	The results of the model are encouraging and show that ...
9	future implications	This new model will be able to ...
10	outline of structure	Section 2 introduces the concept of ...

Below is an analysis of Parts 5–10.

PART 5 SURVEY OF PERTINENT LITERATURE

This part reviews the literature in the author's precise field. As in the previous part, it often draws attention to problems that have still not been solved. For example, you may think a particular study did not investigate some necessary aspect of the area, or how the authors failed to notice some problem with their results.

You only need to describe what is necessary for the specific purposes of your paper. Much of this literature will then be used for comparative purposes in the Discussion.

The length of the literature review (i.e. Parts 4 and 5) ranges from a paragraph to several pages. See Chap. 14 for details on how to write it.

PART 6 AUTHORS' CONTRIBUTION (1–2)*

Here the authors make a very clear statement of how what they describe in the paper represents an advance on current knowledge (i.e. the knowledge outlined in parts 2, 4 and 5).

PART 7 AIM OF THE PRESENT WORK (1–2)*

This statement of the goal to be reached is essential in any Introduction. It should be in a separate paragraph and expressed so that the referee (and readers) are 100% clear about the objectives of your research and the expected outcome. You will need to tell readers what method you used and possibly why you chose this method.

PART 8 MAIN RESULTS OF THE PRESENT WORK (1–4)

Although your main results will be given in other sections of your paper (typically in your Abstract, Results, Discussion and Conclusions), many authors also announce them here to show how the background situation plus their contribution have led to particular results.

PART 9 FUTURE IMPLICATIONS OF THE WORK (1–2)

Some authors prefer to delay mentioning implications to the Discussion or even to the Conclusions. However, mentioning implications here gives readers an instant idea of the possible importance of your work, which may be useful for them as they read the rest of the paper.

PART 10 OUTLINE OF STRUCTURE (3–4 VERY SHORT SENTENCES)

This may not be necessary if the structure of your paper is completely standard for your chosen journal, and thus readers will already know in what order the various elements of your research will be presented. See Sect. 13.8 on how to write the structure.

13.4 I do not work in the field of a 'hard' science. Are there any other ways of beginning an Introduction?

Clearly, not all disciplines would use the structure outlined in Sects. 13.2 and 13.3, though they would still cover some of the same main points. An alternative, and quite common approach, is to set the context and research goal in a series of questions.

Here is an example from a dissertation entitled *The Effects of Feedback and Attribution Style on Task Persistence* by psychology student Chris Rozek. Persistence means the ability to adhere to a task, to persevere with something rather than giving up.

> Persistence is an attribute valued by many. What makes some people persist longer than others? Are internal factors, such as personality traits, or external situational factors, such as feedback, responsible for persistence? Could the answer include a combination of both? These are the questions this experiment attempted to answer.

The general topic is mentioned in the very first word (*persistence*) of a very short sentence (seven words). This enables the reader to immediately focus on and understand the context (corresponding to point 2 in the structure of an Introduction given in Sect. 13.2). Within this context, the second sentence, in the form of a question, outlines the issue that Chris plans to address in his paper (point 3). His next sentence poses the typical attributes associated with persistence (similarly to point 5). The question *Could the answer include a combination of both?* hints at what the likely findings are of his paper (point 7). The final sentence highlights that Chris will cover all the aspects he has mentioned so far. His Introduction then continues with a literature review (point 6) and concludes with his final hypothesis (similarly to point 9).

Chris has neatly covered a lot of points typically mentioned in an Introduction. He has achieved this in very few sentences and with a format (questions) that immediately involves the reader by encouraging them to formulate their own answers and thus to continue reading.

13.5 What typical phrases should I avoid in my Introduction?

Referees have to read a lot of papers. While this can be a very rewarding task, it can also be quite tedious when many Abstracts and Introductions seem to begin in the same way. Thus, some writing experts advise avoiding stock phrases (i.e. typical phrases that everyone uses) at the beginning of the introduction. For example: *Recent advances in ... The last few years have seen ...* Instead they recommended beginning in a more direct way.

13.6 How does an Introduction differ from an Abstract?

There is some overlap between an Abstract and the Introduction. However, a frequent problem is that authors may cut and paste from their Abstract into their Introduction, which can be very repetitive for readers.

Below are the first two sentences from the Abstract and Introduction from a paper (or 'Letter' as it is called in the journal where this study appeared) entitled *Fragmentation of Rods by Cascading Cracks: Why Spaghetti Does Not Break in Half* by Basile Audoly and Sébastien Neukirch. These sentences highlight the distinct ways that an Abstract and Introduction should be written.

> ABSTRACT When thin brittle rods such as dry spaghetti pasta are bent beyond their limit curvature, they often break into more than two pieces, typically three or four. With the aim of understanding these multiple breakings, we study the dynamics of a bent rod that is suddenly released at one end.

INTRODUCTION The physical process of fragmentation is relevant to several areas of science and technology. Because different physical phenomena are at work during the fragmentation of a solid body, it has mainly been studied from a statistical viewpoint [1–5].

The Abstract immediately tells the readers the specific topic of the paper and then what the author's goal is (corresponding to Points 2, 3 and 7 in the structure of an Introduction given in Sects. 13.2 and 13.3). Instead, the Introduction sets the context in very general terms (Point 2).

The abstract then continues as follows.

ABSTRACT We find that the sudden relaxation of the curvature at this end leads to a burst of flexural waves, whose dynamics are described by a self-similar solution with no adjustable parameters. These flexural waves locally increase the curvature in the rod, and we argue that this counterintuitive mechanism is responsible for the fragmentation of brittle rods under bending.

As you can see, the Abstract gives no further background information, but highlights what the authors found in their research. An absolute minimum number of words have been used. This gives the Abstract substantial impact by telling readers only what they need to know to enable them to decide whether to read the whole paper. As is standard for Abstracts, no references to the literature are made.

On the other hand about 50% of the rest of the Introduction is dedicated to helping the readers see that the general trend given in the first two sentences is being countered by another line of research. In this case, references to the literature are made. Readers are alerted to the alternative trend by the link word *nevertheless*.

INTRODUCTION Nevertheless a growing number of works have included physical considerations: surface energy contributions [6], nucleation and growth properties of the fracture process [7], elastic buckling [8, 9], and stress wave propagation [10]. Usually, in dynamic fragmentation, the abrupt application of fracturing forces (e.g. by an impact) triggers numerous elementary breaking processes, making a statistical study of the fragments sizes possible. This is opposed to quasi-static fragmentation where a solid is crushed or broken at small applied velocities [11].

The concluding sentence of the Abstract is:

ABSTRACT A simple experiment supporting the claim is presented.

This eight-word sentence is expanded considerably in the Introduction, by describing more about what the experiment consisted in, and the result it gave. Note: the text reported below is the rest of the Introduction in its entirety.

INTRODUCTION Here we consider such a quasi-static experiment whereby a dry spaghetti is bent beyond its limit curvature. This experiment is famous as, most of the time, the pasta does not break in half but typically in three to ten pieces. In this Letter, we explain this multiple failure process and point out a general mechanism of cascading failure in rods: a breaking event induces strong flexural waves which trigger other breakings, leading to an avalanche like process.

I suggest you use a similar comparison between Abstracts and Introductions taken from your chosen journal, to see:

- what parts from Sects. 13.2 and 13.3 are covered in the Introduction. In the spaghetti paper, Parts 1–8 are condensed into eight sentences, Parts 9 and 10 are not mentioned
- how they are structured differently
- what elements from the Abstract the Introduction expands on
- how sentences from the Abstract are paraphrased in the Introduction
- what information is covered in the Abstract but not in the Introduction, and vice versa
- the relative word counts. This will give you an idea of the proportionate length of the Introduction compared to the Abstract. In the spaghetti paper the Abstract is 116 words, and the Introduction 201 words, so the Introduction is approximately twice as long. This is quite typical

13.7 What tenses should I use?

In this section, the example sentences S1, S3 and S5 are taken from Audoly and Neukirch's paper (Sect. 13.6), and S2, S4 and S6 from Rozek's paper (Sects. 13.4 and 14.2).

The PRESENT SIMPLE is generally used to begin the Introduction in order to describe the general background context, i.e. what is known already.

S1. The physical process of fragmentation *is* relevant to several areas of science and technology.

S2. Persistence *is* an attribute valued by many.

The PRESENT PERFECT is then used to show how the problem has been approached from the past until the present day.

S3. Because different physical phenomena are at work during the fragmentation of a solid body, it *has mainly been studied* from a statistical viewpoint [1–5].

S4. Persistence *has most often been studied* in terms of cultural differences.

During the review of the literature several tenses are used (Sect. 14.4).

At the end of the Introduction, the PRESENT SIMPLE is used again when the authors state what they will do in the rest of their paper (*we explain, I hypothesize*).

S5. In this Letter, we *explain* this multiple failure process and *point out* a general mechanism of cascading failure in rods: a breaking event induces strong flexural waves which trigger other breakings, leading to an avalanche like process.

S6. Because of these findings, I *hypothesize* that subjects with internal attribution styles (as measured by the APCSS), higher levels of perfectionism, and any form of feedback *will show* greater task persistence.

In S5 Audoly and Neukirch use the PRESENT SIMPLE to report their findings (see the underlined verbs). Not all authors use the PRESENT SIMPLE in this context because

a general convention (but not rule) is that when you present your findings you use the PAST SIMPLE - the idea is to use the PRESENT SIMPLE for what is already accepted in the literature, and the PAST SIMPLE for your new contribution (Sect. 16.7).

In S6 Rozek uses the FUTURE SIMPLE to talk about his claim / conclusion. This usage of the future tends to be confined to where authors set out to prove a hypothesis, rather than to give hard results.

13.8 How should I outline the structure of my paper?

Check with your journal's instructions to authors with regard to whether an outline of the structure is required. If it is, or if you notice that all the papers in the journal have one, then your aim should be to describe this structure as concisely as possible (as in the RV).

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
The paper is structured as follows: in Section 2 a survey of the works related to X is provided. In Section 3 the method that we propose for the analysis of X is shown. In Section 4 the tool that automatizes this methodology is presented and in Section 5 its components are described. In Section 6 the experience in the application of the tool to industrial case studies is reported and discussed and finally, in Section 7, conclusions are provided and future works described.	Section 2 *surveys* the works related to X. Section 3 *outlines* our method for analyzing X. In Section 4 the tool that automatizes this methodology is presented, and in Section 5 its components are described. Section 6 *discusses some industrial case studies* using the tool.

The RV is approximately half the length of the OV, 45 words rather than 84. This is achieved by:

- deleting unnecessary sentences. Some journals and reviewers advise that there is no need to have an initial sentence saying *The paper is structured as follows.* Simply beginning a new paragraph at the end of the Introduction is enough to alert the reader that you are now going to talk about the structure
- using active verbs (*surveys*) rather than only passive (*a survey ... is provided*). For the sake of variety, the RV also includes some passive forms. But you could, if you wish, use active forms throughout and thus would further reduce the length of the paragraph
- removing other redundancy. For example, the phrase *the experience in the application of the tool to industrial case studies is reported and discussed* is unnecessarily verbose

13.9 Summary: How can I assess the quality of my Introduction?

To make a self-assessment of your Introduction, you can ask yourself the following questions.

- Is my research question clear?
- Does my Introduction act as a clear road map for understanding my paper?
- Is it sufficiently different from the Abstract, without any cut and pastes? (some overlap is fine)
- Have I mentioned only what my readers specifically need to know and what I will subsequently refer to in the Discussion?
- Have I been as concise as possible?
- Have I used tenses correctly? PRESENT SIMPLE (general background context, description of what will be done in the paper), PRESENT PERFECT (past to present solutions), PAST SIMPLE (my contribution, though this may also be expressed using the PRESENT SIMPLE or FUTURE SIMPLE)

Chapter 14
Review of the Literature

What key skills are needed when writing a Review of the Literature?

The key skill is to provide readers with just the right amount of literature regarding the sequence of events leading up to the current situation - not too much to make it tedious, nor too little so that the context of your research is not meaningful to them. The background information is useful because it allows you to:

- Systematically elaborate the achievements and limitations of other studies
- Relate your new facts and data to these studies

The amount of detail you need to give varies immensely from discipline to discipline. In some disciplines you may be required to have a very strong theoretical framework for your study, thus requiring two or more pages.

In other disciplines just one paragraph may be enough. So another skill is to take into account readers who are up to date with your research area and thus not to delay giving the new information for too long.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_14, © Springer Science+Business Media, LLC 2011

Typical complaints of referees

The author has not made it clear why some references are mentioned. They appear to be there just to make the paper longer (in which they succeed perfectly) and seem more important (in which they fail), rather than as support for the author's approach.

The authors do not seem to be aware of the state of the art, I strongly recommend they widen their literature search. In addition, they have too many references from work carried out in their own country - the literature review is not international enough and the context is thus too myopic.

There are papers cited in the bibliography that are not mentioned in the paper, and vice versa. These should be removed or added as appropriate.

14.1 How should I structure my Review of the Literature?

A Literature Review generally answers the following questions, and generally in the following order. You can use the answers to these questions to structure your Literature Review.

1. What are the seminal works on my topic? Do I need to mention these?
2. What progress has been made since these seminal works?
3. What are the most relevant recent works? What is the best order to mention these works?
4. What are the achievements and limitations of these recent works?
5. What gap do these limitations reveal?
6. How does my work intend to fill this gap?

14.2 How should I begin my literature review? How can I structure it to show the progress through the years?

Below is an extract from the Introduction to a paper entitled *The Effects of Feedback and Attribution Style on Task Persistence* where psychology student Chris Rozek begins his review of the literature (see Sect. 13.4 for how he begins the Introduction).

> Persistence has most often been studied in terms of cultural differences. Blinco (1992) found that Japanese elementary school children showed greater task persistence than their American counterparts. School type and gender were not factors in moderating task persistence. This left culture as the remaining variable.
>
> Heine et al. (2001) furthered this idea by testing older American and Japanese subjects on responses after success or failure on task persistence. Japanese subjects were once again found to persist longer (in post-failure conditions), and this was speculated to be because they were more likely to view themselves as the cause of the problem. If they were the cause of the problem, they could also solve the problem themselves; although, this could only be accomplished through work and persistence. Americans were more likely to believe that outside factors were the cause of failure.
>
> These cultural studies hinted that task persistence may be predictable based on attribution style. A later experiment showed that attribution style and perfectionism level can be correlated with final grades in college-level classes (Blankstein & Winkworth, 2004).

The first sentence of the first paragraph introduces the main topic (cultural differences), and the rest of the paragraph briefly reviews a major study on this topic. The implications of this study (culture as the remaining variable) are summarized at the end of the paragraph.

The first sentence of the second paragraph then moves on to the next (in chronological terms) major study. Chris summarizes Heine's work in a way that involves the reader: he uses the verb *speculated* and then continues the next sentence using *if* which gives an example of this speculation.

The first sentence of the third paragraph summarizes the findings of the first two paragraphs in order to introduce some more recent findings.

Note also his use of tenses. In his first sentence, which is a very general overview, he uses the PRESENT PERFECT. Then when he talks about the work of specific authors and makes a summary of each step in the chronology of the literature he uses the PAST SIMPLE.

Chris's structure is thus:

1. introduction to topic
2. support from the literature
3. mini summary
4. introduction to next topic. And so on.

This technique works very well because it tells a story - it is a logical build up to the reason behind Chris's investigation that readers can easily follow. In fact, the final sentence to his Introduction begins: *Because of these findings, I hypothesize that* … Chris has gradually prepared his readers for the focus of his work: his own personal hypothesis regarding persistence.

You can find another (longer) example of a literature review that adopts similar strategies in Sect. 10.2.

14.3 What is the clearest way to refer to other authors? Should I focus on the authors or their ideas?

There are various styles for making reference to other authors. The four styles below contain the same information, but the focus is different.

STYLE 1 *Blinco [1992] found* that Japanese elementary school children showed …
STYLE 2 *In [5] Blinco found* that Japanese elementary school children showed …
STYLE 3 A *study* of the level of persistence in school children *is presented by Blinco* [1992].
STYLE 4 A greater level of persistence has been noticed in Japan [*5*].

In Style 1, the author, Blinco, is given as much importance as what he (i.e. Blinco) found. You might choose this style for one of three reasons: (i) it is simply the easiest style to use and the most readable for authors, (ii) you may want to focus on the

author more than what he/she found, (iii) you may want to compare two authors (e.g. *While Blinco says X, Heine says Y*).

Style 2 is similar to Style 1, but in this case perhaps you are talking about more than one paper by Blinco, so in this case the paper is the most logical first element in the sentence.

In Style 3, what Blinco found is more important than the fact that Blinco found it. This is a very typical style, but inevitably involves using the passive, which then leads to longer and heavier sentences.

In Style 4 Blinco is not mentioned at all, but only a reference his paper in parentheses.

The style you use will depend on your journal's "Style Rules", but is likely to contain an element of flexibility. In fact, Chris Rozek's Introduction in Sect. 14.2 he uses two styles:

> Heine et al. (2001) furthered this idea by testing …
>
> … can be correlated with final grades in college-level classes (Blankstein & Winkworth, 2004)

He does this to:

- Change the focus from author to findings
- Create variety for the reader

14.4 What tenses should I use?

The PRESENT SIMPLE (S1) or PRESENT PERFECT (S2) are generally used to introduce the literature review.

S1. In the literature there *are* several examples of new strategies to perform these tests, which all *entail* setting new parameters [Peters 1997, Grace 2004, Gatto 2005].

S2. Many different approaches *have been proposed* to solve this issue.

Use the PRESENT PERFECT again to refer to ongoing situations, i.e. when authors are still investigating a particular field. Even though specific past dates are mentioned in S3 and S4 below, these dates are part of a series of dates that describe situations that researchers are still working on today and will continue in the future.

This means that PAST SIMPLE cannot be used in any of these three cases.

S3. Since 1998 there *have been* many attempts to establish an index [Mithran 1999, Smithson 2002], but until now no one *has managed* to solve the issue of ….

S4. As yet, a solution to Y *has not been found*, although three attempts *have been made*. [Peters 1997, Grace 2004, Gatto 2007].

S5. So far researchers *have* only *found* innovative ways to solve X, but not Y [5, 6, 10].

In S3–S5 note the underlined words. These are adverbials of time that are typically used with the PRESENT PERFECT because they indicate something that began in the past (i.e. when research first began in this area) and continues into the present. They represent unfinished situations.

You must use the PAST SIMPLE when:

- The year of publication is stated within the main sentence (i.e. not just in brackets)
- You mention specific pieces of research (e.g. you talk about initial approaches and methods that have subsequently probably been abandoned)
- You state the exact date when something was written, proved etc.

In S6–S8 below we are talking about completely finished actions, so the PRESENT PERFECT cannot be used.

S6. The first approaches *used* a manual registration of cardiac images, using anatomical markers *defined* by an expert operator along all images in the temporal sequence. Then in 1987, a new method *was introduced* which …

S7. This problem was first analyzed in 1994 [Peters].

S8. Various solutions were found in the late 1990s [Bernstein 1997, Schmidt 1998].

In all other cases, the simplest solution is to follow the style of the examples below.

S9. Lindley [10] *investigated* the use of the genitive in French and English and his results *agree* with other authors' findings in this area [12, 13, 18]. He *proved* that …

S10. Smith and Jones [11, 12] *developed* a new system of comparison. In their system two languages *are / were compared* from the point of view of … They *found* that ….

S11. Evans [5] *studied* the differences between Italian and English. He *provides / provided* an index of .. He *highlighted* that …

In S9–S11 the first verb introduces the author and is typically used in the PAST SIMPLE. Other similar verbs are, for example: *examine, analyze, verify, propose, design*, *suggest, outline*.

Note that the first verb in S9–S11 could also be in the PRESENT SIMPLE. However, generally when the PRESENT SIMPLE is used the construction is slightly different (S12): first the reference and then the author.

S12. In [5] Evans studies the differences ….

In any case, even in S12 the SIMPLE PAST (*studied*) would be fine.

The second verb in S9–S11 describes what the authors found. In S9 *agree* is logical because Lindley's findings still agree today with the findings in the papers referenced at the end of the sentence. In S10 and S11, both PAST SIMPLE and PRESENT SIMPLE are possible. However, it is common to use the PRESENT SIMPLE when describing how a system, method, procedure etc. functions. In S10 the PRESENT

SIMPLE underlines that Smith and Jones are still using their system and that it is still valid. The use of the PAST SIMPLE (*were compared*) in S10 would probably imply that Smith and Jones' system is not in use anymore and it was just a step in this road of research that has subsequently been superseded.

The third verb in S9–S11 indicates what the author managed to do (*find, obtain, prove, demonstrate, highlight*), and typically such verbs are used in the PAST SIMPLE (*found, obtained* etc.*).* Again, however, some authors use the PRESENT SIMPLE in such cases.

Use the PRESENT SIMPLE to discuss previously published laws, theorems, definitions, proofs, lemmas etc. Such published work is generally considered to be established knowledge and the use of the PRESENT SIMPLE reflects this.

S13. The theorem *states* that the highest degree of separation is achieved when …

S14. The lemma *asserts* that, for any given strategy of Player 1, there is a corresponding …

14.5 How can I reduce the amount I write when reporting the literature?

Redundancy is often high in the review of the literature, as highlighted in the OVs below.

	ORIGINAL VERSION (OV)	REVISED VERSION (RV)
1	Long sentences *are known to be* characteristic of poor readability [Ref].	Long sentences *are* a characteristic of poor readability [Ref].
2	*In the literature* the use of long sentences *has also been reported* in languages other than English [Ref].	Long sentences *are* not exclusive to English [Ref].
3	The use of long sentences *has been ascertained* in various regions of Europe during the Roman period [Ref].	Long sentences *were used* during the Roman period in various regions of Europe [Ref].
4	The concept of author-centeredness *has been suggested as playing* a role in the construction of long sentences [Ref].	Author-centeredness *may play* a role in the construction of long sentences [Ref].
5	*Several authors have proposed* that in scientific writing the occurrence of a high abundance of long sentences *is* correlated to … [Ref].	In scientific writing the occurrence of a high abundance of long sentences *may* be correlated to … [Ref].

The OVs are not bad English, and if you use them occasionally they are absolutely fine. However, if you always refer to the literature in this way you will create a series of unnecessarily long sentences with considerable redundancy. This makes it hard for the reader to immediately identify the key points of the literature.

Nearly all the words in italics in the OVs could be removed. This is because the reader knows from the reference (*[Ref]*) at the end of the sentence that you are discussing another author's work or one of your previous papers. See Chap. 7 on how to make a clear distinction between your current work, your previous work and the work of others.

However, if you do remove the words in italics, you still have to indicate whether something is known to be true (OVs 1–3), or is simply a suggestion or a proposal (OVs 4–5). For things that are known to be true today (RVs 1–2) you can use the PRESENT SIMPLE, and for things that are known to be true regarding the past (RV 3) you can use the PAST SIMPLE. To indicate that something has been suggested or proposed, you can use *may* (RVs 4–5). Because you have put the reference, your use of *may* indicates a general feeling in the community and not exclusively your feeling.

14.6 How can I talk about the limitations of previous work and the novelty of my work in a constructive and diplomatic way?

Sometimes in the Literature Review you want your readers to note the strong features of your work and the limitations of previous works by other authors. If what you propose has never been done before, you can begin your sentence as indicated by the words in italics below.

As far as we know, there are no studies on …

To [the best of] our knowledge, the literature has not discussed …

We believe that this is the first time that principal agent theory has been applied to …

If you want to mention the limitations of previous works you could adapt one or more of the following sentences:

Generally speaking patients' perceptions are *seldom* considered.

Results often appear to *conflict* with each other …

So far X *has never been applied* to Y.

Moreover, no attention has been paid to …

These studies have *only* dealt with the situation in X, *whereas* our study focuses on the situation in Y.

To learn more about how to highlight your contribution and discuss the limitations of others see Chaps. 8 and 9, respectively.

14.7 Summary: How can I assess the quality of my Literature Review?

To make a self-assessment of your Literature Review, you can ask yourself the following questions.

- Have I mentioned only what my readers specifically need to know and what I will subsequently refer to in the Discussion?
- Are the papers I have mentioned in a logical order? Is it clear why I have chosen these papers and not others?
- Have I selected a disproportionate number of papers from my own country?
- Have I followed my journal's instructions regarding how I make references to the literature? Where possible have I done this in a variety of ways?
- Have I removed any redundancy when reporting the literature?
- Have I used tenses correctly? PRESENT SIMPLE (descriptions of established scientific fact), PRESENT PERFECT (at the beginning of review to give general overview; for past-to-present evolutions), PAST SIMPLE (when specific dates are mentioned within a sentence; for the verbs that introduce an author's findings)

Chapter 15
Methods

What key skills are needed when writing the Methods?

This section has several different names including: 'Methods', 'Methods and Materials', 'Experimental', 'Method Description and Validation'. In this chapter, I will always refer to it as Methods.

In most journals the Methods section follows the Literature Review, in others it follows the Conclusions.

The secret of writing this section is to be able to describe the materials you used in your experiments and/or the methods you used to carry out your research, in a way that is sufficiently detailed to enable others in your field to easily follow your method and, if desired, even replicate your work. A key skill is to make sure the descriptions are complete and yet are also as concise as possible, for example by referring to other works in the literature, including your own, that make use of the same or similar methods.

Another key skill is to write extremely clearly, with generally not more than two steps described in one sentence, and in a logical order. This will then enable your readers to easily follow your description.

Researchers generally agree that the Methods the easiest section to write because your methods are likely to be clear in your mind, so it may be a good point for you to begin writing your manuscript.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_15, © Springer Science+Business Media, LLC 2011

Typical complaints of referees

The methods are not adequately described and are incomplete. How many samples were collected at each sampling? Which sampling method was used and why? Which fraction was analyzed?

No data treatment is shown (statistics, replicates, etc.). Statistical analysis must be reported.

Some of the procedures used were in no way obvious. The authors should justify their rationale for choosing such procedures. At other times the authors repeated a lot of well known published data, when they could have simply used a reference.

15.1 How should I structure the Methods?

The Methods section should answer most of the following questions, obviously depending on your discipline:

- What / Who did I study? What hypotheses was I testing?
- Where did I carry out this study and what characteristics did this location have?
- How did I design my experiment / sampling and what assumptions did I make?
- What variable was I measuring and why?
- How did I handle / house / treat my materials / subjects? What kind of care / precautions were taken?
- What equipment did I use (plus modifications) and where did this equipment come from (vendor source)?
- What protocol did I use for collecting my data?
- How did I analyze the data? Statistical procedures? Mathematical equations? Software?
- What probability did I use to decide significance?
- What references to the literature could I give to save me having to describe something in detail?
- What difficulties did I encounter?
- How does my methodology compare with previously reported methods, and what significant advances does it make?

You should provide enough quantitative information (concentration, temperature, weight, size, length, time, duration etc.) so that other researchers can replicate what you did. Describe everything in a logical order to enable readers to easily follow what you did. This will usually be chronological (but see Sect. 15.9), i.e. the order in which you conducted the phases of your tests. It may also help the reader if you use subheadings to explain the various stages of the procedure, which you can then use again (perhaps with modifications) in the Results.

Your experiments, sampling procedures, selection criteria etc. may have more than one step. It helps your readers if your description of each step follows the same logical order.

Ensure that you cover every step required. Because you are very familiar with your method, you may leave out key information either thinking that it is implicit (and thus not worth mentioning) or simply because you forget.

15.2 How should I begin the Methods?

How you begin will very much depend on your discipline. To help you decide, take a look at the Methods section in papers from your chosen journal, and see how authors start this section.

Typical ways include:

(a) making a general statement about your method

The method described here is simple, rapid, sensitive and ...

(b) referring to another paper

The materials used for isolation and culture *are described* elsewhere [20].

Materials *were obtained* in accordance with Burgess et al.'s method [55].

(c) stating where you obtained your materials from

Bacterial strains ... *were isolated* and kindly supplied by ...

Agorose for gel electrophoresis *was purchased* from Brogdon plc (Altrincham, UK).

(d) explaining how you found your subjects, i.e. begin with the setting

Subjects *were chosen* from a randomly selected sample of ...

Participants *were selected* from patients at the Gynecology Faculty of the University of ...

(e) indicating where (i.e. a geographical region) your investigation was focused

Our empirical investigation focused on Tuscany, a central region of Italy, ...

The study *was carried out* in four boulevards in Athens (Greece) and ...

(f) referring the reader to a figure which shows the experimental set up

To highlight the advantages of the system, Fig. 1 shows the ...

(g) starting directly with the first step in your procedure

Frontal cerebral cortices *were dissected* from ...

Core-cell composite materials *were prepared* by colloidal assembly of ...

15.3 What tense should I use? Should I use the active or passive?

Most Methods sections are written in the PAST SIMPLE using the passive form. Examples of this usage are highlighted in italics in the examples in Sect. 15.2.

The PAST SIMPLE is required because the actions you describe took place in the past (i.e. before you started to write your paper). The PAST SIMPLE also helps to

distinguish what you did from what others have done (which is often described in the PRESENT SIMPLE).

The passive is good style here because the focus is on what was done rather than who did it. Thus you can ignore any expert advice that tells you that the passive should always be avoided. It should be avoided, but only where it is not necessary. In the Methods the passive is both necessary and appropriate.

Greg Anderson, who is the genius behind the biology website at Bates College in Maine, USA, writes the following about the style you should adopt in the Methods section. What he writes clearly not only applies to the field of biology.

> The style in this section should read as if you were verbally describing the conduct of the experiment. You may use the active voice to a certain extent, although this section requires more use of third person, passive constructions than others. Avoid use of the first person in this section. Remember to use the past tense throughout - the work being reported is done, and was performed in the past, not the future. The Methods section *is not* a step-by-step, directive, protocol as you might see in your lab manual.

15.4 How many actions can I refer to in a single sentence?

A frequent problem in the Methods is that the description reads like a manual, where each individual detail or action is described in a single sentence. Given that you are describing a procedure rather than making a complex analysis, it is perfectly acceptable to have two actions in one sentence.

Below is the first paragraph from a medical paper in which the author describes how she selected the participants for her survey on depression. The word 'practice' means an association of medical doctors who offer a service to the public. The 'list size' is the number of patients the practice has.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
A first postal invitation to participate in the survey was sent to 26 practices in South Yorkshire. A total of five practices indicated their willingness to participate. Multidisciplinary focus groups in four diverse practices were purposively identified. The identification entailed using a maximum variation approach. This approach was based on socio-economic population characteristics and ethnic diversity. These characteristics were taken with reference to census data.	Following a first postal invitation to participate sent to 26 practices in South Yorkshire, five responded positively. Multidisciplinary focus groups in four diverse practices were purposively identified using a maximum variation approach, based on socio-economic population characteristics and ethnic diversity (by reference to census data).

The OV is in correct English and is perfectly acceptable provided that this style is not used continuously throughout the Methods. If it is used continuously, the reader will soon find it tedious, particularly as each sentence begins in the same way (i.e. with a noun).

The technique of the RV is simply to combine two steps into a single sentence, with no extra effort on the reader's part in terms of understanding.

On the other hand, you do not want to have too much information in the same sentence. In the OV below, the reader would find the information much more difficult to assimilate than in the RV, even though the information given is exactly the same.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
The four practices, which had been previously identified as having list sizes between 4750 and 8200, comprised firstly an inner city practice (hereafter Type 1) with an ethnically diverse population for which the team frequently required translators for primary care consultations, secondly, two urban practices with average levels of socio-economic deprivation (Type 2), and thirdly, a mixed urban/rural practice (Type 3).	The four practices had a list size ranging between 4750 and 8200. They comprised: • an inner city practice with an ethnically diverse population, where the team frequently required translators for primary care consultations • two urban practices with average levels of socio-economic deprivation • a mixed urban /rural practice

In the first three lines of the OV, two pieces of information are included, where the additional information is placed between commas (in italics below):

> The four practices, *which had previously been identified as having list sizes between 4750 and 8200*, comprised firstly an ...

This kind of construction should not be used too often as it separates the subject (*practices*) from the verb (*comprised*) – see Sect. 4.9. Readability is generally increased when the subject and verb are close together, as in the RV. The next lines of the OV then continue with a list of three items. It is much easier if these items are put into three different sentences.

15.5 How can I avoid my Methods appearing like a series of lists?

It is important to be concise in the Methods. But conciseness does not mean writing a series of lists (as in S1). This style may be appropriate on a presentation slide, but should be avoided in a paper. What you write should always sound natural if read aloud. S1 does not sound natural.

S1. Processes which often occur in lipids include: oxidation, hydration, dehydration, decarboxylation, esterification, aromatisation, hydrolysis, hydrogenation and polymerization. Factors that affect the chemistry of these materials include: heat (anthropogenic transformations), humidity, pH, and microbial attacks.

S2 still contains the same *processes* and *factors* as S1, but the way these are introduced sounds more natural - even though it requires more words.

S2. Several processes often occur in lipids, including oxidation, hydration, dehydration, decarboxylation, esterification, aromatisation, hydrolysis, hydrogenation, and polymerization. In addition, the chemistry of these materials can be affected, for example, by heat (anthropogenic transformations), humidity, pH, and microbial attacks.

15.6 Can I use bullets?

The second RV in Sect. 15.4 uses bullets to list the three types of practices. This makes it easier to read and also provides variety in the layout. However, refer to your journal's style guide to check whether bullets are permissible.

You only need to number your bullets if each bullet describes a step that is part of a chronological sequence.

15.7 How can I reduce the word count?

The style of the first RV in Sect. 15.4 is to present more than one action per sentence. This reduces the number of words that are required - the RV is more than 20% shorter than the OV.

Other ways to reduce the word count are:

- assume your readers have basic knowledge of the techniques used in your field, you can thus delete any superfluous information
- cite a reference rather than detailing the procedure again if any of your methods are fully described elsewhere (in one of your papers or someone else's)
- use tables and figures to summarize information
- be concise - see Chap. 5

15.8 How should I designate my study parameters in a way that my readers do not have to constantly refer backwards?

In the second OV in Sect. 15.4 the author has designated the three types of medical practices as Type 1, Type 2 and Type 3. This enables her to save time whenever she has to refer to one of the practices. It saves her time, but not the reader. Later

in the Methods (or even in the Results or Discussion), whenever readers see, for example, Type 1 they will have to refer backwards to remember which practice Type 1 refers to.

Although I generally recommend being concise, in this case conciseness is annoying for readers. It is much easier for readers to read *inner city practice* than *Type 1*.

Another timesaver for the author is to use an invented acronym. So in this case, the author could have written *ICP* for *inner city practice*. But the same problem arises: the reader is forced to remember what *ICP* refers to.

15.9 Should I describe everything in chronological order?

The basic idea is present everything in your experiments, trials, procedures etc. in a way that will make best sense to your reader. The fact you did something before or after something else, may not be relevant for your reader, so in such cases chronology is not important.

However within a sentence or paragraph, readers should feel they are moving forward chronologically.

S1. *The sample, which was filtered and acidified at pH 2, was mixed with X.

S2. *The sample was filtered and acidified at pH 2 and then mixed with X.

S3. The sample was filtered and acidified at pH 2, and then mixed with X.

S4. The sample was filtered and acidified at pH 2. It was then mixed with X, which enabled the resulting solution to stabilize at ...

In S1 the main idea is that the sample was mixed with X, but we seem to be going backwards (to the filtering and acidification) before we go forwards again to the mixing. S2 resolves this problem by removing the *which*-clause and presenting the steps in sequence. However, S2 uses *and* twice, which means the reader may be initially confused with regard to which two items are connected with each other (*filtered* + *acidified*, or *acidified* + *mixed*). This is resolved in S3 by the addition of a comma after *pH 2*. However the clearest version is S4, which simply begins a new sentence.

S1 is an example of a very short sentence that could be rewritten more clearly. Often such sentences are much longer, so the technique given in S4 (rather than S3) is often the best solution.

15.10 What grammatical constructions can I use to justify my aims and choices?

You often need to be able to explain why you made certain choices in the light of what they subsequently enabled you to do.

To introduce your choices you can use the following constructions:

In order to validate the results, we first had to ...

In an attempt to identify the components, it was decided to ...

To provide a way of characterizing the samples, an adaptation of Smith's method [2011] was used.

For the purpose of investigating the patients previous medical history, we ...

Our aim was to get a general picture of ...

This choice was aimed at getting a general picture of ...

The examples highlight that there are many ways (not all mentioned here) to express your aims and intentions. The important thing is to choose the right verb form (see the underlined verbs in the examples): the infinitive (*to test*) or the *-ing* form (*of testing, at testing*).

However, all the examples could be expressed much more simply using the infinitive form alone (e.g. *To validate the results. To identify the components. To characterize the samples*).

Another way to talk about your choices is to use the verb *to choose*. But note the construction:

This equipment was *chosen for* its low cost.

This equipment was *chosen (in order) to* save money.

15.11 What grammatical construction is used with *allow, enable* and *permit*?

There are several verbs in English that mean 'give the capability of' and highlight for your readers what your initial choices subsequently helped you to achieve.

Allow and *enable* are the most commonly used in research papers, and outside computer science they can generally be used interchangeably. Another verb is *to permit*, which is used less frequently as it often has the meaning of an authority

giving someone the permission to do something. All three verbs require the same specific construction. In the examples below I have just used *allow*, but in all these examples from a grammatical point of view *allow* could be replaced with *enable* and *permit*.

GRAMMATICAL CONSTRUCTION	EXAMPLE
allow someone or something to do something	This equipment allowed us to identify X.
allow someone or something to be + past participle	This equipment allowed X to be identified.
allow + noun	This equipment allowed the identification of X.

All three examples mean exactly the same thing. The first is the shortest and most commonly used. It is also the one that gives rise to the most mistakes. This is because *allow, enable* and *permit* require an agent before the infinitive. Hence the use of *us* in the first example is obligatory.

Allow, enable and *permit* involve long constructions but can often be eliminated, generally without any change in meaning. If you find yourself using *allow* and *enable* very frequently, then consider using the alternatives given below. In some cases you may feel that the RV is slightly different in terms of meaning from the OV, in such cases it is best to stick with the OV.

ORIGINAL VERSION (OV)	REVISED VERSION (RV)
Limiting the Xs *allows* the complexity of Y *to be reduced* and permits *the user to control* the deduction process.	Limiting the Xs *reduces* the complexity of Y, and *facilitates control* of the deduction process.
The analysis *allowed the characterization of pine resin* as the main organic constituents in the sample to be achieved.	The analysis *showed that pine resin* was the main organic constituent in the sample.
This model *permits the analysis* of X.	This model *can analyze* X.
	With this model *we can analyze* X.
	With this model, X can be determined
The use of these substrates *enabled us to highlight* the presence of several nucleases.	The use of these substrates:
	highlighted the presence of ...
	meant that we were able to highlight the presence of ...
	offered a means *to highlight* the presence of ...

Note that in the RVs, the verb *let*, which means the same as *allow, enable* and *permit*, has not been used because in most journals it is considered too informal.

15.12 How can I indicate the consequences of my choices and actions?

In Sect. 15.10 we saw how (i) to indicate the rationale behind your choices, then in 15.11 (ii) what this choice enabled you to do. Now we will look at how to describe the consequences of (i) + (ii). Here are some examples:

S1. An evaluation of this initial data demonstrated that X = Y,
thus giving an insight into the function of Z.
thereby providing a basis for investigating the function of Z.

S2. An evaluation of this initial data demonstrated that X = Y.
Consequently the next step was to investigate the function of Z.
The next step was *thus / therefore / consequently* to investigate ...

The examples above give two alternative endings.

In S1 the sentence is in two parts divided by a comma after *Y*. Note how *thus* and *thereby* require the *-ing* form after them. The *-ing* form alone, without *thus* and *thereby* could be ambiguous (Sect. 6.5).

In S2 the first sentence ends with Y. The first word in the next sentence is *consequently*. It would be possible to put *thus* and *therefore* (but not *thereby*) at the beginning of the sentence too but their most natural position is after the verb *to be* (Sect. 2.12). Other alternative words are *hence*, which is most generally used in mathematics, and *so*, which is generally considered too informal for research papers.

15.13 How should I use the definite and indefinite articles in the Methods?

Below is the first part of the entire experimental section of a paper entitled *Growth of Diamond Films from Tequila* by Mexican researchers Javier Morales et al. Their English reflects the typical use of English in scientific papers, by native and non-native authors, but which EFL and EAP trainers may find strange.

> Small pieces of *a Si* (100) wafer and commercial stainless steel (type 304) were used as substrates, fixed to the holder through silver paste. *Temperature* was controlled at 850°C through *an automatic* PID temperature control (Eurotherm). *Reactor pressure* varied from 4.76 to 4.99 Torr due to the injection processes and to the flash evaporation phenomena. The carrier and reaction gases flux were fixed at 0.8 and 0.1 l/min, respectively. “Tequila blanco” (white tequila) Orendain brand, a clear, un-aged liquor distilled from the juice of blue agave (Agave Tequilana) plant [9], was used *as precursor*.

In italics I have highlighted some issues with articles (*a/an, the*). In the first line *Si* stands for silicon. If you read the sentence you would probably read it as: *a silicon wafer* and not *an Si wafer*. *Si* is not an acronym - you would say, for example, *an SOS*, because each letter in SOS stands for a separate word. In SOS the S is pronounced ESS and therefore requires *an* (see Sect. 11.15) because of the initial vowel sound (as in *an automatic* in the third line).

In Morales' paper, like in most scientific papers, the use of *a* and *the* goes against the normal rule of a singular countable noun requiring a preceding article (see Sects. 6.6 and 11.14). Morales uses, like many native speakers, *temperature* and *reactor pressure* without a preceding *the*. However, other authors opt to use *the* in exactly the same situation. Clearly in such contexts both forms are permissible.

Likewise, Morales writes *as precursor*, which in general English would have to be *as a precursor*, which is what some other authors in the literature use. So again, in these cases at least, both forms seem to be possible, though the solution with *a* is twice as common.

15.14 Should I write numbers as digits (e.g. 5, 7) or as words (e.g. five, seven)?

Below is the second and final part of Morales' experimental, which highlights some useful points with regard to numbers.

> This tequila, 80 proof and with C-H-O atomic relationships of 0.37 C, 0.84 H and 0.29 O (Figure 1), was injected at a frequency of 2 pulses per second (500 ms) with an opening time of 4 ms. A total of 21768 pulses were applied in each experiment and a micro dose of 6.26×10^{-3} ml was injected per pulse (Table 1). Temperatures in the evaporation zone and along the vapor transport line were fixed at 280°C. The deposit was studied through a Dilor micro-Raman spectrometer with a 20 mW, 632 nm He-Ne laser equipped with a confocal microscope and a JEOL Low-Vacuum Scanning Electron Microscope (JSM-6060LV), operating at 15 kV, secondary electrons, spot 50 and WD 11 mm.

The use of numbers varies from journal to journal and paper to paper. In Morales' paper all the numbers are written as digits rather than words (e.g. *2 pulses* rather than *two pulses*).

Other journals recommend using words for numbers from one to ten, and then digits. However this rule does not apply when the number precedes an abbreviation for a measurement (e.g. *9 mm*, not *nine millimeters*).

Note also that abbreviations for measurements do not have an *s* when they are plural (e.g. *9 mm*, not *9 mms*).

Another rule of style prohibits beginning a sentence with a number in digits. For this reason Morales correctly writes

... opening time of 4 ms. A total of 21768 pulses were applied ...

rather than

... opening time of 4 ms. 21768 pulses were applied ...

In fact, you can see clearly from these two examples why the rule exists. It exists to help readers see the numbers more clearly. Alternatively, you can begin a sentence with a written number:

Twenty thousand pulses were applied …

Clearly, if you begin a sentence with a number in words, the number has to be a short number. Writing the following would be ridiculous:

Twenty one thousand seven hundred and sixty eight pulses were applied …

The last sentence of Morales' experimental contains nine pieces of information, but it is not difficult to follow, and it would be strange to break the sentence down into smaller parts.

15.15 How can I avoid ambiguity?

Morales' experimental (see Sects. 15.4 and 15.13) is easy to read and follow. One reason for this is that it contains no ambiguity. There is no phrase that forces the reader to stop and interpret the meaning.

Unfortunately, not all Methods are written in this way.

In Robert Day's informative and very amusing book *How to Write and Publish a Scientific Paper*, several real examples of ambiguous sentences from Methods sections are given. Here are two of them:

S1. *Employing a straight platinum wire rabbit, sheep and human blood agar plates were inoculated ...

S2. *Having completed the study, the bacteria were of no further interest.

In S1 it seems that the rabbits were made of platinum wire, and in S2 it seems that the bacteria were responsible for completing the study. You may think that the real interpretations are very obvious, but the fact that Robert Day mentions them means that some referees and readers will also find them amusing and/or aggravating. One solution is to improve the punctuation as in S3, where a comma has been added after *wire*.

S3. Employing a straight platinum wire, rabbit, sheep and human blood agar plates were inoculated with ...

In S3 a comma has been added after *wire*. But the sentence is still not immediately clear because the use of a series of commas initially makes it seem like a list of things that were employed. S4–S6 are much clearer.

S4. Rabbit, sheep and human blood agar plates were inoculated with … by employing a straight platinum wire.

S5. Employing a straight platinum wire, we inoculated rabbit, sheep and human blood agar plates with …

S6. Rabbit, sheep and human blood agar plates were inoculated with ... This was carried out using a straight platinum wire.

S2 could be rewritten as:

S7. Once the study had been completed, the bacteria were of no further interest.

For more on such problems of ambiguity, see Chap. 6.

15.16 What other points should I include in the Methods? How should I end the Methods?

Not all Methods sections are as short as the one by Morales et al. (Sects. 15.13 and 15.14).

In some papers the methods are the main contribution of the paper. In such cases, subsections with subheadings (e.g. *sampling procedure, experimental set up, testing the model*) may help readers to understand the various stages or various components.

Your first subsection may be a general overview of the methods chosen, how they relate to the literature and why you chose them.

Then in each subsequent subsection you:

1. preview the part of the procedure / method you are talking about
2. detail what was done and justify your choices
3. point out any precautions taken (this also helps you gain credibility as a researcher who carries out his / her work accurately and thoroughly)
4. discuss any limitations in your method or problems you encountered
5. highlight the benefits of your methods (perhaps in comparison to other authors' approaches)

If your Methods section is short and does not require any subsections, then you could end it with one or more of points 3–5 above. If it is long, then you could end with some conclusions regarding the limitations and benefits (points 4 and 5) of your overall methodology.

However, many authors follow Morales' approach - essential, concise and no conclusions. As usual, the best solution is to analyze the Methods section in various papers that have been published in your chosen journal.

15.17 Summary: How can I assess the quality of my Methods section?

To make a self-assessment of your Methods section, you can ask yourself the following questions.

- Have I really described my Methods in a way that is easy for readers to follow and which would enable them to replicate my work? Have I ensured that I have covered every step? Is my structure clear and complete?
- Have I been as concise as possible? Have I used references to previous works rather than repeating descriptions that readers could easily find elsewhere?
- Do the individual sentences in each paragraph contain too many, too few, or just the right manageable number of steps? Have I ensured that my sentences don't sound like lists?
- Have I thought about the way readers prefer to receive information? (no ambiguity, no back referencing, everything in chronological order, headings, bullets)?
- Have I checked my grammar (infinitive, gerund, *allow, thus* etc.) with regard to how I outline how and why I made certain choices?
- Have I checked my journal's guidelines on how to use numbers?
- Have I used tenses correctly? PAST SIMPLE (in the passive form to describe what I did), PRESENT SIMPLE (descriptions of established scientific fact)

Chapter 16
Results

What key skills are needed when writing the Results?

Not all journals require a separate Results section, often it is integrated with the Discussion, under the section title Results and Discussion.

If you have a separate Results section then the standard procedure is to present them with little or no interpretation or discussion. This means that the Results is generally the shortest section in a paper.

The key skill is first to decide what results are representative, and then to organize them in a sequence that highlights the answers to the aims, hypotheses or questions that you set yourself at the beginning of the paper. In many disciplines this involves the use of figures and tables, which are commented on in the text. In other disciplines, findings are only reported in text form.

You should also mention any important negative results here.

From an English point of view the key skill is in reporting your results simply and clearly. If the referees of your paper cannot understand your results, then your contribution to the current knowledge base will be lost.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_16, © Springer Science+Business Media, LLC 2011

Typical complaints of referees

At times this paper reads like a thesis. The authors seem to have included all their results, with the consequence that I am not sure which findings are significant and which are not. However, I also suspect that some contradictory findings have not been included. So although I generally recommend brevity, this should not include leaving out key findings that do not support the authors' line of logic.

The Results section is too long and much of it is then repeated in detail in the Discussion. Moreover, most of the empirical results are rather obvious. That X = Y is hardly surprising. I cannot see any new or important aspects of this study.

Rather than highlighting the results that are significant or relevant, the authors have merely repeated in the text everything that they have put in their figures and tables, which in themselves seem to include every piece of data that the authors have elaborated in the last three years. This makes for very tedious reading. Moreover, I felt that I was not given the tools to understand for myself the significance of their data.

16.1 How should I structure the Results?

The Results should answer the following questions.

1. What did I find?
2. What did I not find?
3. What did I find that I was not expecting to find? (e.g. that contradicts my hypotheses)

A typical structure is to follow the order you used for the protocols or procedures in your Methods. You then use figures and tables to sequence the answers to the above questions.

16.2 How should I begin the Results?

There are two typical ways to begin the Results. The first is to give a general panorama of your surveys, experiments etc. without repeating the details you gave in the Methods section, as in the three examples below:

> Overall, the results presented below show that …
>
> The three key results of this empirical study are: …
>
> The following emergent themes were identified from the analysis: …

The most common way is to simply go directly to your results, often by inviting readers to look at one of your figures or tables, either in the first sentence or very shortly after:

> Figure 1 shows the mass spectra obtained from an analysis of the two residues. The first residue reveals a .. (Fig. 1a)
>
> A total of 34 wheat genotypes (Table 1) were screened for … Responses to increased sunlight varied significantly (Figure 1) …
>
> An analysis was made to look for … To do this, the average times of x and y were compared … Figures 1–3 show the differences between …

16.3 How should I structure the rest of the Results? How should I end the Results?

Before you begin writing, arrange your figures (tables etc.) in the most logical order for your readers, and which supports your initial aim or hypothesis that you stated in your Introduction. Then associate key findings with each of your figures, excluding any results that are not relevant in supporting your research hypothesis.

Note that 'not relevant' does not include results that contradict your hypothesis (Sect. 16.4).

The rest of the section then consists in commenting on these figures one by one. Maeve O'Connor in her book *Writing Successfully in Science*, recommends the following structure.

1. Highlight those results (including those from controls) that answer your research question
2. Outline secondary results
3. Give supporting information
4. Mention any results that contradict your hypothesis and explain why they are anomalous

16.4 Should I report any negative results?

Yes!

Dr Ben Goldacre, a campaigner against the suppression of negative data in medical papers, says:

> When you get a negative result, it feels as if it's all been a bit of a waste of time. It's easy to convince yourself that you found nothing, when in fact you discovered a very useful piece of information: the thing that you were testing doesn't work.

Of course, you may have got negative results for other reasons:

- your hypothesis was incorrect and needs to be reformulated
- you had a bad experimental design and / or low statistical power

As Dr. Donald Dearborn, of Bates College, comments:

> Your results may be of importance to others even though they did not support your hypothesis. Do not fall into the trap of thinking that results contrary to what you expected are necessarily "bad data". If you carried out the work well, they are simply your results and need interpretation. Many important discoveries can be traced to "bad data".

Negative data are frequently commented on in the Discussion (Sects. 17.12 and 17.13).

16.5 What tenses should I use when reporting my Results?

Your results are things that you found before you started writing the paper. They therefore relate to past events, consequently the PAST SIMPLE is used to report them, often in a mixture of the active and passive forms.

Below are some results from a medical paper. The author, medical doctor Caroline Mitchell, interviewed GPs (i.e. doctors) and nurses in the British National Health Service (NHS) to discover practices (in this case what is known as a *care model*) relating to depression. The indented parts in inverted commas are quotations of what the doctors and nurses said (I have only reported the beginnings of the quotations).

> The care model, *was seen* as a credible and holistic approach to the management of depression. GPs were keen to avoid 'over-medicalising' and over-prescribing of antidepressants:
>
> > "The big difference to the way we manage is having the mental health worker here more often, because …"
>
> However, there was a perceived failure of the NHS to provide adequate services to support adherence to the guideline. One GP *commented*:
>
> > "It's interesting when you look at the sort of treatments that …"
>
> GPs and mental health workers *described* very limited access to specialist input for patients with more complex, treatment-resistant or recurrent depression. One incident *was described* by a GP:
>
> > "I tried recently with a gentleman who has been on antidepressants for four or five years, …"

Dr Mitchell uses the PAST SIMPLE throughout but switches between the active and passive forms. When the topic is the most important element she uses the passive (*the care model was seen, one incident was described*). When it makes more sense to use a human subject, she uses the active (*one GP commented. workers described*).

16.6 What style should I use when reporting my Results?

When describing her results (Sect. 16.5), Dr Mitchell uses an impersonal style. This serves to add an element of objectivity to her findings. For instance, she does not say

S1. We found that doctors viewed the NHS as having failed to provide adequate services.

Instead she says:

S2. There was a perceived failure of the NHS to provide adequate services.

However, both S1 and S2 are accepted styles.

Note how the quotations in Dr Mitchell's text act like the figures and tables of other types of paper, by providing evidence for what is expressed in the sentences that precede them.

Here is an extract from another paper (Sect. 13.4), which again uses an impersonal style.

> Three levels of feedback *were looked* at for differences on task persistence. Differences between positive, negative, and no feedback conditions, were minimal and showed no significant findings … There were larger differences both between genders and in the interaction between gender and feedback conditions. Tables 1 and 2 *show* the averages for these gender differences. Figure 6 *shows* …

Note how the author uses the passive (*were looked at*) rather than the active (*I / we looked at*). This usage may either reflect the author's wish to remain in the background and let his results speak for themselves, and / or because he is following his journal's requirements. However, he uses the active when referring to figures and tables (*Figure 6 shows*).

16.7 Can I use a more personal style?

Here are some extracts from a Results section in a paper by economist, Andrea Mangani, regarding differences in content between online and print newspapers in Italy. The extracts highlight a much more personal style of reporting results:

> Collecting the data was quite difficult … On the other hand, the statistical analysis is rather simple. Table 2 shows … Notice that the difference between online and print variety increases during the daytime; this means that the diversity in online content tends to decrease from 09.30 to 17.30. We wondered whether the smaller degree of online variety depended on …

This kind of writing is less formal and helps the reader to become more involved in the research process. Andrea tells readers of his difficulties in collecting the data, but the ease of which he managed to analyze these data. He draws his readers' attention to the significance of his data (*Notice that* …). His readers are also involved in his thought and decision processes (*we wondered whether*). The result is a paper that reads a little a like a story, and is much more enjoyable to follow and therefore easier to digest.

Two more things to note:

- Andrea uses the PRESENT SIMPLE when interpreting his data (*online content tends to decrease*). This is very common when referring to data that clearly indicate a certain trend.
- Although Andrea was the sole author of the paper and conducted the research entirely by himself, he refers to himself as *we*. This is quite common in some journals where the use of the first person singular (*I*) is considered too informal.

Andrea's reader-friendly style may also be appropriate in the Discussion section.

16.8 How can I show my readers the value of my data, rather than just telling them?

Professor of ecology Ken Lertzman of the Simon Fraser University, gives the following advice in an excellent document available for download (page 313).

> Rather than telling the reader that a result is interesting or significant, show them how it is interesting or significant … show the reader what they need to know to come to their own conclusion about the result.

Ken gives two examples to highlight the difference:

S1. *The large difference in mean size between population C and population D is particularly *interesting*.

S2. While the mean size generally varies among populations by only a few cm, the mean size in populations C and D *differed by 25 cm*. Two hypotheses could account for this, …

In S1, the adjective *interesting* means something very definite for the author, but not for the reader who has not been given the tools to assess why the *mean size* is *interesting*. Such descriptive adjectives (*interesting, intriguing, remarkable*) are rarely helpful (see Sect. 9.4 for the dangers of such adjectives).

You need to give your readers sufficient information for them to be able to say to themselves: "wow that is interesting!" This is what S2 does by highlighting specific details (*differed by 25 cm*).

Adverbs such as *interestingly, intriguingly, remarkably* also suffer from the same problem. However, they can be used effectively if used at the beginning of a sentence, in order to attract attention to a key finding. So S2 becomes S3:

S3. *Interestingly*, while the mean size generally varies among populations by only a few cm, the mean size in populations C and D *differed by 25 cm*. Two hypotheses could account for this, …

However this technique should be used only once or twice in the whole paper, otherwise it loses its effect.

16.9 How should I comment on my tables and figures?

Dr Lertzman has similar ideas about 'showing not telling' with regard to figures and tables:

> When writing Results sections you should use the tables and figures to illustrate points in the text, rather than making them the subject of your text.

Following his advice, S1 should be rewritten as S2.

S1. *Figure 4 shows the relationship between the numbers of species A and species B.

S2. The abundances of species A and B were inversely related (Figure 4).

In S1 the author is merely telling readers what they can already see in the figure. S2 is much more helpful, because it focuses on the meaning that can be inferred from the figure. S1 forces readers to make their own interpretations (which may in fact be interpretations that you don't want them to make). S2 saves readers from making any mental effort and at the same time guides them towards the interpretation that you want them to have.

The OVs in the table below highlight some examples related to commenting on figures and tables.

	ORIGINAL VERSION (OV)	REVISED VERSION (RV)
1	As can be seen in Figure 1, levels of intolerance were highest during late adolescence.	Levels of intolerance were highest during late adolescence (Figure 1).
2	We can see from Table 2 that in the control group, values for early adolescence (13–15) were 6.5. On the other hand, values for mid adolescence (16–17) were 6.7.	Values for early adolescence were lower than for mid adolescence: 6.5 versus 6.7 (Table 2).
3	Figure 1 shows that levels of intolerance are 9, 15 and 20 during early, mid and late adolescence, respectively.	Levels of intolerance are highest during late adolescence (Figure 1).

Lack of conciseness is a frequent problem when describing data in figures and tables (Sect. 5.13). Avoid phrases such *as can be seen* (OV1) and *we can see* (OV2). Simply put the figure or table reference in brackets at the end of the sentence. OV2 also repeats information that should already be contained in the table, i.e. the respective age ranges for the three stages of adolescence.

To learn how to make concise references to figures and tables see Sect. 5.13.

RV2 combines the two sentences from OV2. Rather than just repeating the data in the table (as in OV2), RV2 interprets the data by comparing the results.

RV3 highlights that you do not need to reiterate each value from a figure or table. You just need to point out the key result or trend that the figure or table conveys.

Another typical mistake is to repeat word for word the caption / legend to your figures and tables within the main text. Legends should be as short as possible and be sufficiently detailed to enable your readers to understand the figure or table without having to read your text. It is vital that you pay attention to legends as some readers may only look at your figures and tables, without even reading the paper itself!

16.10 What is the difference between reporting and interpreting?

If you have a separate Results section, then the experts recommend that you should not make any interpretations of your data. Deciding what constitutes reporting and what constitutes interpreting is not straightforward. RV2 and RV3 in Sect. 16.9

interpret the data only in the sense that they highlight the importance of the data for the readers but without adding any subjective comments.

This is not the case in S2 below, which along with S1 is taken from the biology website at Bates College in Maine, USA (see link on page 312 (15.3)).

S1. The duration of exposure to running water had a pronounced effect on cumulative seed germination percentages (Fig. 2). Seeds exposed to the 2-day treatment had the highest cumulative germination (84%), 1.25 times that of the 12-h or 5-day groups and four times that of controls.

S2. The results of the germination experiment (Fig. 2) suggest that the optimal time for running-water treatment is 2 days. This group showed the highest cumulative germination (84%), with longer (5 d) or shorter (12 h) exposures producing smaller gains in germination when compared to the control group.

In S1 the authors highlight the trend / difference that they want the reader to focus on, no subjective interpretation is given. On the other hand, in S2 the reference to optimality is a conceptual model to which the observed result is then tied.

This differentiation between objective reporting and subjective interpretation is not an easy skill to acquire. If you are worried that your Results section may contain elements of subjectivity that are not appropriate (in terms of your field of study, or the requirements of your journal), then you should consider showing it to someone with considerable experience in writing who can certainly be someone of the same nationality as this is not essentially a language issue.

However, if your Results and Discussion are combined into one section, then S2 would be perfectly acceptable.

16.11 How can I make it clear that I am talking about my findings and not the findings of others?

None of the RVs in Sect. 16.9 make reference to the author, e.g. RV3 says *levels of intolerance are highest* rather than *we found that levels of intolerance are highest*. This means that there is a possibility that readers will not be clear about whether these are your findings or another author's. In RV1 and RV2, this is not a problem because it is a convention to use the PAST SIMPLE (*were*) to talk about your findings. In RV3, the PRESENT SIMPLE (*are*) might seem to indicate that this is established scientific fact, but the reference to Figure 1 indicates that this is your finding and not someone else's.

In any case, you need to make 100% sure that readers will understand whose findings you are talking about. For more on this topic see Chap. 7.

16.12 Summary: How can I assess the quality of my Results section?

To make a self-assessment of your Results section, you can ask yourself the following questions.

- Have I expressed myself as clearly as possible, so that the contribution that my results give stands out for the referees and readers?
- Have I limited myself to only reporting the key result or trends that each figure and table conveys, rather than reiterating each value?
- Have I avoided drawing conclusions? (this is only true when the Results is an independent section)
- Have I chosen the best format to present my data (e.g. figure or table)? Have I ensured that this is no redundancy between the various figures and tables?
- Have I ensured that my tables of results are comprehensive in the sense that they do not exclusively include points that prove my point?
- Have I mentioned only what my readers specifically need to know and what I will subsequently refer to in the Discussion?
- Have I mentioned any parts of my methodology (e.g. selection and sampling procedures) that could have affected my results?
- Have I used tenses correctly? PAST SIMPLE for your findings (in the passive form), PRESENT SIMPLE (descriptions of established scientific fact)

Chapter 17
Discussion

What key skills are needed when writing the Discussion?

People read papers in different ways. Readers in a hurry, may read the title and then just look at the figures! Many begin from the part that they find the most interesting, which is often the Discussion.

Most authors find discussing their results to be the most difficult part of the paper to write. When referees reject a paper, it is very often due to a poorly written Discussion. As one of my PhD students commented:

> It is a 'grey zone' where I have to express my point of view without a specific or logical 'grid'. Writing the introduction is easier because you can be really helped by the articles that you have read.

Although there is no *grid* (i.e. template) in which to insert your own text, there is a general pattern or structure to most Discussions. This chapter is designed to teach you various strategies to simplify the process of discussing your results. You will learn how to structure the Discussion and how to ensure that what you write will satisfy the typical requirements of the referees.

The secret is to sound both convincing and credible at the same time. You can do this by being positive about your own limitations, and constructive when discussing what you believe to be the limitations of others.

Another skill is to interpret your results without repeating them.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_17, © Springer Science+Business Media, LLC 2011

Typical complaints of Referees

The Discussion fails to relate the findings and observations to other relevant studies, and there appears to be no discussion on the implications and limitations of these findings.

The main result of this study was that P = Q. However no exhaustive explanations are given. The authors simply limit the discussion on P by reporting previous findings that are already documented in several papers. I find this kind of discussion too speculative and limited.

The author claims improved efficiency and easy management. However, he did not include any experimental results showing how fast the new system would work (in terms of performance) compared to the traditional method. If the author does not chose to include the actual implementation, this defect can be pointed out in the limitation/future work section as a subsection in the Discussion section.

17.1 How should I structure the Discussion?

The Discussion should answer the following questions, and possibly in the following order. You can thus use the answers to structure your Discussion. This gives you a relatively easy template to follow.

1. Do my data support what I set out to demonstrate at the beginning of the paper?
2. How do my findings compare with what others have found? How consistent are they?
3. What is my personal interpretation of my findings?
4. What other possible interpretations are there?
5. What are the limitations of my study? What other factors could have influenced my findings? Have I reported everything that could make my findings invalid?
6. Do any of the interpretations reveal a possible flaw (i.e. defect, error) in my experiment?
7. Do my interpretations contribute some new understanding of the problem that I have investigated? In which case do they suggest a shortcoming in, or an advance on, the work of others?
8. What external validity do my findings have? How could my findings be generalized to other areas?
9. What possible implications or applications do my findings have? What support can I give for such implications?
10. What further research would be needed to explain the issues raised by my findings? Will I do this research myself or do I want to throw it open to the community?

Whatever your discipline you will need to answer all the questions above, with the possible exception of question 8 (your findings may only be very preliminary). Whether you answer questions 8–10 will depend on whether you have a separate Conclusions section, if so, the Conclusions may be a more appropriate place.

It may make sense for you to organize your Discussion following the same sequence as your presented your findings in the Results section. In this case, you discuss each survey, study or experiment, and interpret it within the overall scenario of the problem.

If you are a medical researcher, you will need to follow closely the appropriate guidelines (e.g. CONSORT, PRISMA, MOOSE, STROKE). Even if you are not a medical researcher these guidelines are still incredibly useful and you can find links to them at bmj.com. The Results and Discussion section of a medical paper typically has the following subsections:

1. Statement of principal findings
2. Strengths and weaknesses of the study
3. Strengths and weaknesses in relation to other studies: important differences in results
4. Meaning of the study: possible explanations and implications for clinicians and policymakers
5. Unanswered questions and future research

The above subsections equally apply to most other disciplines (if you replace *clinicians* with ‘others in my field’). In any case, check out your chosen journal’s website to see if they have similar recommendations on how to structure the Discussion.

17.2 How should I begin the Discussion?

Below are four possible beginnings for the same paper (see Sect. 13.4 for the paper in question).

(1) Remind readers of your goals, preferably in a single sentence:

> One of the main goals of this experiment was to attempt to find a way to predict who shows more task persistence.

(2) Refer back to the questions (hypotheses, predictions etc.) that you posed in your Introduction:

> These results both negate and support some of the hypotheses. It was predicted that greater perfectionism scores would result in greater task persistence, but this turned out not to be the case.

(3) Refer back papers you cited in your Review of the Literature:

> Previous studies conflict with the data presented in the Results: it was more common for any type of feedback to impact participants than no feedback (Shanab et al., 1981; Elawar & Corno, 1985).

(4) Briefly restate the most important points from your Results:

> While not all of the results were significant, the overall direction of results showed trends that could be helpful to learning about who is more likely to persist and what could influence persistence.

You could begin with any of 1–4 above, or perhaps use them all in combination. Next, you give readers a very brief statement of what you can conclude from your findings. You can then use this statement as a starting point for interpreting your findings and comparing them to what is already known in the literature.

Some experts recommend that you tell a story to help you build up your theory, where your variables, data or findings are like characters in a book. Your job as the author is to explain how these 'characters' relate to each other, and how each one has (or has not) its logical place.

17.3 Why should I compare my work with that of others?

Dr Greg Anderson and Dr. Donald Dearborn of Bates College (Maine, USA) give the following advice to their students:

> You may find crucial information in someone else's study that helps you interpret your own data, or perhaps you will be able to reinterpret others' findings in light of yours. In either case you should discuss reasons for similarities and differences between yours and others' findings. Consider how the results of other studies may be combined with yours to derive a new or perhaps better-substantiated understanding of the problem.

A good structure for doing this is:

1. Make a general statement regarding your findings
2. Mention another author's work that relates directly to your findings
3. Make a link between her/his work and your work
4. Clearly state how your work differs from her/his work
5. State the conclusions that can be drawn from your results in light of these considerations

17.4 How should I compare my work with that of others?

The following text is an example of how to compare your work with others in the Discussion. It comes from a paper entitled *Exploring Stock Managers' Perceptions of the Human Animal Relationship on Dairy Farms and an Association with Milk Production* by Catherine Bertenshaw and Peter Rowlinson. See page 313 for a link for downloading the full text. The authors did a postal survey of 516 UK dairy (i.e. milk) stockmanagers (i.e. farmers) about how they believed humans could affect the productivity, behavior and welfare of cows and heifers (young female calves that have not given birth). Nearly half said they called their cows by name – such cows had a 258 liter higher milk yield than those who that were not called by their name. About 10% said that a fear of humans resulted in a poor milking temperament.

Below is the beginning of the Discussion section:

(1) Our data suggests that UK dairy farmers largely regard their cows as intelligent beings, capable of experiencing a range of emotions. Placing importance on knowing the individual animal and calling them by name was associated with higher milk yields.

(2) Fraser and Broom [1997] define the predominant relationship between farm animals and their stock managers as fear.

(3) Seventy-two percent of our commercial respondents thought that cows were not fearful of humans, although their reports of response to an approaching human suggest some level of fear, particularly for the heifers. With both cows and heifers this would appear to be greater in response to an unfamiliar human. Respondents also acknowledged that negative experiences of humans can result in poor behavior in the parlor.

(4) Hemsworth et al. [1995] found that 30–50% of the variation in farm milk yield could be explained by the cow's fear of the stockperson, therefore recognizing that fear is important for animal welfare, safety, and production.

In (1), Catherine begins with an overall summary of her key finding and its implications. In (2) she mentions a previous study (by Fraser) in the same topic area and thus connects her findings with the literature.

Fraser's study gave contrasting results to what Catherine reveals in (3). However, in (3) Catherine also tries to account for some of what Fraser's found (*although … heifers*) and in (4) finds further confirmation of Fraser's findings in another study.

Catherine thus adopts a diplomatic approach in which she questions the findings of other authors in a constructive way. She uses their results either to corroborate her own results, or to put her results and their results in a new light.

Another useful skill that Catherine uses throughout her Discussion, is that she constantly clarifies for the reader between whether she is talking about her findings or those of other authors (Sects. 7.3, 7.4, and 7.7), or whether she is just talking in general,

(5) The elaborated responses reported in *our postal survey* contribute some examples of the capacities of cattle, and this contextual human insight may be useful for developing hypotheses for further study.

(6) Most respondents (78%) thought that cows were intelligent. (7) However, a *study by Davis and Cheek* (1998) found cattle were rated fairly low in intelligence. *They* suggested that the ratings reflected the respondents' familiarity with the animals. (8) The stock managers in *our survey* were very familiar with their cattle and had a great understanding of the species' capabilities, through working with them daily. (9) *Stockpersons' opinions offer* valuable insight into this subject, which could enable more accurate intelligence tests to be devised; for example, to test whether cows can count in order to stand at the feed hopper that delivers the most feed.

(10) Hemsworth and Gonyou (1997) doubt the reliability of an inexperienced stockperson's attitudes towards farm animals. *Our* survey found an experienced workforce (89.5% > 15 years).

In (5) Catherine concludes a paragraph by suggesting a future course of action. (6) is the first line of the next paragraph, so it is clear that the *respondents* are her respondents and not another author's.

In (7) she uses *however* to indicate that she is going to give some contrasting information. Her use of *they* clearly refers back to Davis and Cheek.

In (8) Catherine then clarifies for the reader that she is now focusing on her study. She does this again using *our*. If she had not inserted the phrase "in our survey", the reader would not know which stock managers she was talking about. Not making this distinction is an incredibly common error in Discussions and leads to total confusion for the referee and readers. In the literature *our* is often used, even if the style of the rest of the paper is impersonal (i.e. the passive is used, rather than *we*). Using *our* can be crucial in differentiating your work from others.

In (9), like she does in (5), Catherine makes a mini summary of what she has said in the rest of the paragraph. Her use of the SIMPLE PRESENT (*offer*) shows that she is talking about all stockpersons – not just those in her study or in Davis and Cheek's study. She also recommends a course for future action.

In (10) Catherine begins a new paragraph to indicate that she is now going to cover another subtopic. Good use of paragraphs is essential in signaling to readers that you are moving on to discuss something difference (Sect. 8.2). Catherine begins with a reference to the literature to establish to the new subtopic, and then

immediately moves on to her findings to make a contrast between inexperienced and experienced workers.

The rest of her Discussion is structured in a similar manner, in which she provides more conclusive evidence that calling a cow by its name, rather than problems connected with fear, is more likely to affect milk production. In each case, she makes it 100% clear to her readers why she has mentioned another person's work and how it relates to her work.

17.5 How should I end the Discussion if I do have a Conclusions section?

Discussion sections which also have a Conclusions may end as follows:

(a) Tell your readers if and how your findings could be extended to other areas. But you must provide evidence of this. If you repeated your experiment in a different context, would you get the same result?

We only a limited number of samples. A greater number of samples could lead to a higher generalization of our results …

Although this is a small study, the results can be generalized to ...

Our results may hold true for other countries in Asia.

(b) Suggest ways that your hypothesis (model, device etc.) could be improved on.

We have not been able to explain whether x = y. A larger sample would be able to make more accurate predictions.

A greater understanding of our findings could lead to a theoretical improvement in ...

(c) Say if and / or why you ignored some specific areas.

Our research only focuses on x, whereas it might be important to include y as well. In fact, the inclusion of y would enable us to …

We did not pay much attention to ... The reason for this was ...

(d) Admit what you have not been able to do and as a consequence cannot provide conclusions on.

Unfortunately, our database cannot tell the exact scale of Chinese overseas R&D investment. Consequently we cannot conclude that …

(e) Reiterate your reasons for choosing your topic of investigation in order to convince your readers of the validity of what you have said in the Discussion.

As mentioned in the Introduction, so far no one appears to have applied current knowledge of neural networks to the field of mass marketing fraud. The importance of our results using such networks thus lies both in their generality and their relative ease of application to new areas, such as counterfeit products.

The above endings (a–e) are not hugely different from the endings outlined in Sect. 17.4, and may simply be used in addition to, or as an alternative to, those endings.

17.6 How should I end the Discussion if I do not have a Conclusions section?

Whether or not you have a Conclusions section, your Discussion should end with a summary of the main points you want your readers to remember.

Catherine Bertenshaw concludes her Discussion (Sect. 17.4) in the classic way by stating:

(1) what her findings imply

> The attitudinal information from our survey shows that farmers hold cows in very high regard.

(2) what her recommendations are

> These results create a positive profile of the caring and respectful attitudes of UK farmers to their stock, and this image should be promoted to the public further recommendation.

(3) how her research could be continued

> A 56% response rate suggests the respondents are a good representation of UK stock managers. Further on-farm interviews, observations, and animal-centered tests are needed to confirm the inferences made from the data collected in this postal survey.

Many Discussions end in the same way as Catherine's, particularly those that have no Conclusions section. Catherine's paper does in fact have a Conclusions section, but it is only 70 words long and provides an overall summary of her data, and what she thought the implications of her findings might be.

17.7 Active or passive? What kind of writing style should I use?

Before you begin writing, look at your chosen journal to see whether authors use an active/personal or passive/impersonal style (Sect. 7.1). Also, check with the journal's style guide.

In the Discussion you will constantly be comparing your work with other author's. In your head you know what you did, and you know what other authors have done. But the reader doesn't. You need to make a very clear distinction, so that in every sentence the reader is 100% clear about whose work you are referring to (Sects. 7.3, 7.4, 7.7, and 7.8).

Passive sentences do not reveal the author of the action and so the reader will not understand if you are referring to your findings or another person. So, to avoid ambiguity, where possible use active sentences.

The table below shows five examples. The first two make it 100% clear to the reader whose work is being talked about. The other three are in order of decreasing clarity. In the final example the reader has no idea whose work is being discussed - this is a very typical mistake in papers and is a very dangerous way of referring to the literature.

EXAMPLE	COMMENTS
In 2010, *we confirmed* that complex sentences reduce readability [25].	*We* clearly indicates that you are referring to your own work.
In 2011, *Carter suggested* that complex sentences could also lead to high levels of stress for the reader [36].	*Carter*, who is another author, is the subject of the verb. Thus it is clear to the reader that this is not your work.
In 2011, *it was suggested* that complex sentences could also lead to high levels of stress for the reader [Carter, 36].	The passive form means that the reader is not sure until the end of the sentence if it was you or another author. A long literature review or Discussion full of sentences like this is very heavy and annoying for the reader.
In 2011, *it was suggested* that complex sentences could also lead to high levels of stress for the reader [25].	Readers cannot know who made the suggestion unless they go to Ref. 25 and see if it was you or someone else.
In 2011, *it was suggested* that complex sentences could also lead to high levels of stress for the reader.	There is no reference. Readers cannot be sure if you made the suggestion or someone else.

17.8 How can I give my interpretation of my data while taking into account other possible interpretations that I do not agree with?

In a paper that won him an Ignobel Prize, Magnus Enquist made a case for the fact that chickens are able to discriminate between good looking and ugly human beings. Here is an extract of the Discussion section of his paper, *Chickens prefer beautiful humans*.

> (1) We cannot of course be sure that chickens and humans processed the face images in exactly the same way. (2) This leaves open the possibility that, while chickens use some general mechanism, humans possess instead a specially evolved mechanism for processing faces. (3) We cannot reject this hypothesis based on our data. (4) However, there are at least two reasons why we do not endorse this argument. First, it is not needed to account for the data. We believe that the existence of a task-specific adaptation can be supported only with proofs for it, rather than with absence of proofs against. Second, the evolutionary logic of the argument is weak. (5) From observed chicken behaviour and knowledge of general behaviour mechanisms we must in fact conclude that humans would behave the same way with or without the hypothesised adaptation. There would thus be no selection pressure for developing one.

His strategy for anticipating possible objections to his argument is to:

- admit that he might be wrong - sentence (1)
- put forward an alternative interpretation (2)
- reiterate that his data could be used to confirm this alternative interpretation (3)
- give reasons for not agreeing with this alternative interpretation (4)
- propose his own conclusion (5)

See Sects. 8.10, 9.11 and 9.12 to learn the skills reported above.

17.9 How can I bring a little excitement to my Discussion?

Like a verbal discussion, you can make your Discussion quite animated - you can allow yourself to use stronger language and make stronger assertions than you might do in other parts of the paper. You are basically trying to 'sell' your data, but at the same time considering both sides of the issue.

A colleague of mine who is frequently asked to referee papers in his field recommends:

> Be upfront about your findings and achievements. In my work as a referee I often have difficulty in understanding how significant the authors feel their work is, and why their findings add value. This is because authors are not explicit enough – they don't signal to me (and the reader) that they are about to say, or are now saying, something important. The result is that their achievement may be hidden in the middle of a nondescript sentence in a nondescript paragraph … and no one will notice it.

By *upfront*, he means do not be too modest about your findings, and by *nondescript* he means phrases that do not stand out from the rest of the text. If you really want your contribution to be seen and appreciated, then you cannot use the normal flat phrases (Sect. 8.9) that you might use, for example, when describing your materials or methods.

One way to add some passion to your writing, is the very occasional (Sects. 9.2 and 9.4) use of emotive adjectives (Sect. 8.7) and nouns. The adjectives can be qualitative (e.g. *convincing, exciting, indisputable, undeniable*) or quantitative (*huge, massive*). Typical powerful nouns that suggest a major step forward are: *breakthrough, advance, leap*. These adjectives and nouns can also be used in combination (e.g. *a substantial insight, a massive advance*).

Here are some real examples:

S1. These observations provide *compelling evidence* that a *massive* black hole exists at the centre of NGC4258.

S2. It can be stated that these experiments have provided *undeniable evidence* of an autonomic link-up of the limbic area.

S3. The latter finding is *particularly important* in the sense that it cannot readily be explained socioculturally, thus presenting a *new and convincing argument* for brain-based etiology of this disorder.

S4. Major changes in the business processes and the organizational models are, *of course*, *indisputable reasons* for *drastic* decisions regarding the information systems used by the organization.

S5. *To date no work has been published* on the role of circulating miRNAs in breast cancer—an area where, if feasible, their use as *novel* minimally invasive biomarkers would be an *incredible breakthrough* in our management of this disease.

S6. The possibility of contributing to change the way we communicate with machines is a *very exciting proposition*.

My comments below imagine that the authors are describing their own findings or are discussing their own reasoning. However, this does not necessarily reflect how these sentences were in fact used by the authors.

The claim made in S1 is very strong and will certainly attract attention. It could be made softer (weaker) by preceding it with a preliminary statement, as in S2 (*It can be stated that*).

In S3 the authors back up their claim regarding the finding being *particularly important*, by illustrating its importance. There is no point in saying that something is important, without telling your readers why it is important.

S4 adds emphasis to the adjective *indisputable*, by preceding it with *of course*. This makes the claim appear as if it has already been accepted by the community. The adjective *drastic* adds extra power to the sentence.

S5 would work well as a final sentence in the Discussion, or in the Conclusions. Basically, it serves to show how the authors' work in one field could be extended to another field where, to date, it has never been used before.

S6 would be a great final sentence to a paper. It leaves readers feeling upbeat, i.e. optimistic and encouraged. It also leaves referees with a positive final impression of your paper, which may even affect their willingness or not to recommend the acceptance of your paper.

It is best to use this kind of emotive language wisely, and very infrequently (otherwise it loses its effect). Also, such language may not be considered appropriate in your discipline or in your chosen journal – so check with other papers in your journal.

To learn more on highlighting your contribution, and softening strong claims, see Chaps. 8 and 9, respectively.

17.10 How can I use *seems* and *appears* to admit that I have not investigated all possible cases?

It is crucial to be totally honest and non-misleading as to the status of results.

Let's take the example of a mathematical proof. There may be some cases that you have not checked, i.e. you are making an intuitive claim or guess based on what you have checked so far.

In such cases you can use *it appear*s to be or *it seems*. Such phrases say exactly the truth, i.e. that something is true for the cases you have checked. You are telling the reader that you intuitively suspect or expect that it could be always true, but you don't claim it. That is what 'appears' means. You make no assertion as to the probability because you have not computed or assessed a probability.

> *It appears that* stochastic processes for which x = y can produce finite dimension values.
>
> This completes the proof of Theorem 1. Note how this enables us to determine all the Xs and Ys at the same time. Thus *it seems that* some natural hypotheses can be formulated as ..

However, you must make it 100% clear to the reader that, for example, you have not checked all cases, that your sample size was small, and that some external factors may have influenced you results.

17.11 How can I show the pitfalls of other works in the literature?

There are three areas to call into question regarding the work of other authors.

- Hypotheses that have never really been tested. You want to test them.
- Other studies have only been conducted very generally or in one specific field. You want to apply this research to a new area.
- Other studies have limitations. You are trying to overcome these limitations.

The important thing when criticizing other's work is not to undermine their credibility (Sects. 9.11 and 9.12). The idea is that if you treat others with respect, they will treat you with respect.

17.12 How should I discuss the limitations of my research?

It is essential that you inform readers of any limitations to your research or any failures or contradicting data (Sects. 9.9 and 9.10). There is no need to consider these aspects of your research to be totally negative. Your readers will appreciate

learning about what went wrong, as this may help them with their own research.

However, when you discuss any limitations and failures, try to do so in a positive way – not like in S1 below:

S1. *The limitation of this paper is that the two surveys were not conducted in the same period. This will affect our results in terms of ...

S1 is extremely honest, but could be expressed in a way that sounds less negative, as in S2:

S2. Although the two surveys were not conducted in the same period, this will only affect our results in terms of …

The negative impact of S1 is reduced in S2 by:

- removing the word *limitation* - this is not a bad word to use, but if you use it more than once or twice, the reader may go away thinking that your work has more negative aspects than positive ones. If you have to refer to several limitations, another solution to reduce the possible negative effect on the reader is to use synonyms: *shortfall, shortcoming, pitfall, drawback, disadvantage* etc.
- introducing *although* and *only* – these adverbs qualify what you are saying. In this particular case, *although* immediately tells your reader that you are going to say something negative, but that something positive will immediately follow. *Only* implies a limited number of cases, thus it lessens the level of seriousness of the shortcoming
- combining two sentences into one sentence - this gives the reader less time to ponder on the negative content

When you outline the limitations, you also need to be clear what these limitations are and what exactly the implications are. S3 and S4 fail to do this.

S3. *One limitation of our research was the sample size, which was too small.

S4. *The unfortunate contamination of a few of our samples may mean that some of our conclusions are somewhat misleading.

S3 and S4 are not very helpful and are not likely to please your referees. S3 does not explain why and in what way the sample size was too small, nor what the consequences of this were. S4 does not explain why or how the samples were contaminated, nor to what extent the conclusions are misleading.

S5 and S6 provide much more information, and do so in a more positive way that does not undermine your research too dramatically:

S5. One limitation of our research was the sample size. Clearly 200 Xs are not enough to make generalizations about Y. However, from the results of those limited number of Xs, a clear pattern emerged which …

S6. Two of our samples were contaminated. This occurred because … We thus plan to repeat our experiments in future work. However, our analysis of the uncontaminated samples (24 in total) supported our initial hypothesis that …

The important thing is to be (i) honest, (ii) clear, and, if appropriate, (iii) discuss possible remedies.

17.13 What other ways are there to lessen the negative impact of the limitations of my study?

Another way to lessen the impact of the limitations of your findings is to say that other authors have experienced similar problems, as illustrated in the extract below:

> Analytic expressions for the density (1) were not derived, (2) because their interaction depends on the relative orientation of the spheres, (3) thus making integration considerably more complex. (4) Similar complications in the analytical determination of the density, using the same approach that we used, were experienced by Burgess [2011].

The strategy used in the above extract is:

(1) explain the pitfall (i.e. the limitation in your work)

(2) give reason for the pitfall

(3) outline consequence of the pitfall

(4) refer to a similar pitfall experienced by another author

You can also attribute your limitations to the fact that current knowledge (theories, models, technologies etc.) is unable to resolve the problems you have encountered.

> (1) A full treatment of our problem using Gabbertas's theory (GT) is complicated to handle in our case, (2) *given* the complex geometry. (3) *In fact*, the expressions derived by GT are only available for a few simple geometries [Refs]. (4) *Moreover*, GT is not well suited to describing the upper regions. (5) *An additional problem* is that a theoretical description of X is still the target of active experimental and theoretical research. (6) There is little experimental or theoretical information available for the properties of X [Refs]. (7) *At the same time*, the properties of Y can be described by Burgess's model, (8) *however* its ability to well describe X is still under investigation.

The strategy adopted in the above case is:

(1) say that current theories (models etc.) cannot deal with your problem

(2) give an explanation for (1)

(3 + 4) give support for (1)

Note how (5–8) follow the same pattern as (1–4). The author uses link words (highlighted in italics) to give emphasis and logic to her argumentation and she provides variety by using different link words. Note however that excessive use of link words can be very tedious for readers (Sect. 5.6).

Finally, when discussing your limitations, be consistent. Say either *this worked in 75% of cases* (affirmative approach) or *this did not work in 25%* (negative approach), then stick with just one of the two approaches. Otherwise you are in danger of confusing the reader.

17.14 Summary: How can I assess the quality of my Discussion?

When you have finished writing your Discussion, it is a good idea to make sure you can honestly answer 'yes' to all the questions below. This will enable your peers to make a critical assessment with regard to the strengths and weaknesses of (a) how you carried out your research (b) and how you analyzed your findings. The result will be that you will be seen as a credible researcher.

- Is my contribution to the knowledge gap clear? Have I underlined the significance of my findings?
- Have I explained what I believe to be new and important very clearly but without exaggerating? Have I ensured that I have not over-interpreted my results (i.e. attributed interpretations to them that cannot actually be supported)?
- Have I truly interpreted my results, rather than just reiterating them? Have I shown the relationship (confirmation or rejection) between my results and my original hypothesis? Have I generated new theory rather than simply giving descriptions?
- Is there a good balance, rather than being a one-sided version? Have I really offered alternative explanations?
- Have I clearly distinguished fact from speculation? Will the reader easily be able to understand when I am merely suggesting a possible interpretation rather than providing conclusive evidence for something?
- Have I ensured that there is no bias in my research? (i.e. I have not hidden any of my data or any unexpected results, simply because they do not confirm what I was hoping to find)
- Have I included those works in the literature that do not corroborate my findings? Likewise, have I avoided distorting the magnitude or direction of the data of the literature that I have selected? (i.e. I have made sure that I have not committed publication bias)
- Have I discussed my findings in the context of what I said in the Introduction? Have I exploited my Review of the Literature?
- Have I integrated my results with previous research (including my own) in order to explain what I observed or found?
- Have my criticisms of the literature been justified and constructive?
- Have I ensured that I have not introduced any new findings (i.e. findings not mentioned in the Results)?
- Are all the statements I have made in the text supported by the data contained in my figures and tables?
- Have I removed any trivial information? Have I been as concise as possible?

In addition, remember to make a clear distinction between your work and others but appropriate use of

- *we/our, they/their*
- references in parentheses to the literature
- minimal use of passive form

You can massively improve the structure and the language you use in your Discussion by analyzing how other authors in your field write their Discussion sections. If possible, try to adopt the same approach to analyzing texts as I have used in this chapter.

Chapter 18
Conclusions

What key skills are needed when writing the Conclusions?

One of my PhD students once remarked to me: *I find the conclusions quite difficult to write, even in my own language. If I wrote everything in the paper, what should I add at the end?* Her question sums up the dilemma that authors have with the Conclusions. It's not that the Conclusions section is difficult to write, it's just that authors don't know what to write. In fact, several journals do not even have a separate Conclusions sections, authors simply write a concluding paragraph in their Discussion.

Although the Conclusions may not be the last section that readers read, there is a strong probability that they will be the last thing that the referee reads. Consequently, they must be clear and concise, and leave the referee with a good impression. If your structure and English are poor here then this will have a negative impact on the referees and may affect their final decision as to whether to accept your paper or not.

The key skills are in knowing what referees and readers expect to find in Conclusions, not repeating exactly the same phrases and information from your Abstract and Introduction, and in providing a clear and high-impact take-home message for readers.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_18, © Springer Science+Business Media, LLC 2011

Typical complaints of referees

The Conclusions are just a cut and paste from various other parts of the paper.

The authors have not concluded anything but just given a poor summary of what they have done. Their Conclusions read like someone who would rather be back in the lab, rather than someone who wants readers understand how their investigation may have added to the knowledge base in our field.

The conclusions should be also shortened by avoiding peripheral topics, they did not seem to be the final stone in their build up of logic. I also recommend that the authors should report very clearly why and how these findings may be of interest for future research and applications.

18.1 How should I structure the Conclusions?

The Conclusions section is not just a summary. Don't merely repeat what you said in the Abstract and Introduction. It is generally not more than one or two paragraphs long. A Conclusions section typically incorporates one or more of the following:

1. a very brief revisit of the most important findings pointing out how these advance your field from the present state of knowledge
2. a final judgment on the importance and significance those findings in term of their implications and impact, along with possible applications to other areas
3. an indication of the limitations of your study (though the Discussion may be a more appropriate place to do this)
4. suggestions for improvements (perhaps in relation to the limitations)
5. recommendations for future work (either for the author, and/or the community)
6. recommendations for policy changes

The order these items appear is likely to be the same as suggested above.

It differs from the Abstract and Introduction as it is for a more informed reader. In fact, you are making a summary for readers who hopefully have read the rest of the paper, and thus should already have a strong sense of your key concepts. Unlike the Abstract and Conclusions it:

- does not provide background details
- gives more emphasis to the findings (point 2)
- talks about limitations, which are not normally mentioned outside the Discussion and Conclusions (point 3)
- covers three additional aspects (points 4–6)

On his department's excellent website (see page 313 for a link), Dr Alan Chong of the Faculty of Applied Science and Engineering at the University of Toronto, makes the following comments about the difficulties of writing the Conclusions:

> Students often have difficulty writing the Conclusion of a paper because of concerns with redundancy and about introducing new ideas at the end of the paper. While both are valid concerns, summary and looking forward (or showing future directions for the work done in the paper) are actually functions of the conclusion. The problems then become (1) how to summarize without being completely redundant (2) how to look beyond the paper without jumping completely in a different direction.

The rest of this chapter is dedicated to solving Dr Chong's first problem. The second problem is not a language issue and simply involves making sure that you avoid developing any new directions in significant detail, and that these future avenues should be clearly linked to the work described in your paper.

18.2 How should I begin my Conclusions? How can I increase the impact of my Conclusions?

Here are some beginnings for the Conclusions section. They are typical but in fact make little impact.

S1. We have here described a linear model with an error specification that is considered appropriate for the estimation of … We have found significant evidence of …

S2. In this paper we have presented a statistical study of the nature of … We have shown that it is possible to reason about …

S3. In this paper it has been shown how X can be applied to a wide range of … A novel approach has been introduced to …

S4. In this work it has been attempted to analyze simple feedback loops with … It has been shown that for ...

S1 and S2 use a personal form, S3 and S4 use the passive. What all these examples have in common is that they are boring to read and have almost zero impact on either the referee or the reader. They also match the equally uninteresting first sentences often found in Abstracts (Sect. 12.8).

Just as professional copy editors advise against beginning a paper with *This paper describes*, they also suggest avoiding ending the paper in the same way (*This paper has described*). This is for three reasons:

- they waste a lot of words (5–7 words that tell the reader nothing)
- they delay the main topic
- they are not memorable for the reader and have no impact

It is not difficult to be more direct, as the following examples show.

	ORIGINAL VERSION (OV)	REVISED VERSION (RV)
1	In this study it is concluded that compression plays an important part in … It was found that …	Compression plays an important part in … In fact, it was found that …
2	This work has demonstrated that a number of compounds present in X are responsible for delaying the onset of …	A number of compounds present in X are responsible for delaying the onset of …
3	We have shown that the crystal structure of X reveals that …	The crystal structure of X reveals that …
4	It has been suggested in this paper that the localization of X in neurons is a good marker for neuronal viability.	The localization of X in neurons suggests that it is a good marker for neuronal viability.

The RVs have simply removed the initial 5–8 words of the OVs. This means that the main topic of the paper now appears in the first two to four words of the Conclusions. The result is a Conclusions section that is more concise and has more impact.

The RVs versions are considerably more direct and are found in many disciplines, particularly in medicine and biology related disciplines. If you are worried that they are too direct, then you can make them 'softer' by introducing hedgers (Sects. 9.2–9.6). So RV2 becomes *could be responsible*, and RV3 *seems to reveal* (RV4 already contains the verb *suggest*, which in itself is a good hedger).

In RV4 the passive form (*has been suggested*) has been replaced by an active form (*suggests*) while still maintaining an impersonal construction – this may be important if your journal does not allow you to use *we* (Sect. 7.1). In any case, using the passive form in the Conclusions is perfectly acceptable as it allows you to put your main topic at the beginning of the sentence.

> A simple method of extracting gold from plastic *has been described*.
>
> The gold found in waste materials *has been demonstrated* to produce more than 100 kg of gold per day from a typical recycling plant.

If the above two sentences had appeared in the Introduction, they might have been ambiguous. Given that they are in the passive there is no subject for the verb, so readers cannot be 100% sure if the author is referring to his/her own work or someone else's. However, in the Conclusions such ambiguity rarely arises because the reader is assumed to have read at least some other parts of the paper and thus knows that these are the authors' conclusions about their own work.

18.3 How can I differentiate my Conclusions from my Abstract?

In this section I am going to analyze an example from a writing skills exercise I set my PhD students. Below are an Abstract and Conclusions by Chiara Vallebona. She uses a model to predict how very heavy rain will erode soil in the near future. Note that the data presented below are completely hypothetical as no such study has actually been conducted.

Here is how Chiara begins her Abstract and Conclusions.

> ABSTRACT An increase in storm frequency and intensity is expected for the Mediterranean area. The aim of this study is to assess the risk of soil erosion in sub-basin croplands in Tuscany, Italy.
>
> CONCLUSIONS We assessed the risk of soil erosion in the Trasubbie (*Tuscany, Italy*) sub-basin croplands by using a scenario analysis.

The main topic (*the risk of soil erosion*) is the same in both sections, but the focus is different. In the first sentence of the Abstract, Chiara gives some background information. In the Conclusions, there is no background information. Instead in the first sentence of the Conclusions, Chiara summarizes the main activity of her research. In the Abstract, she mentions the location as a wide area (Tuscany, Italy), which she

thinks her readers will be familiar with. In the Conclusions she is more precise about this location (Trasubbie, a much smaller land area in Tuscany) – readers will have read the paper at this point so this precise location makes sense. Her Abstract and Conclusions then continue as follows.

> ABSTRACT We explored the potential response of soil erosion patterns to changes in temporal distribution and intensity of rainfall events, land-use, and soil conservation management practices by analyzing various scenarios. Most soil erosion is associated with a limited number of intensive-to-extreme rainfall events. Assessing the spatially-distributed soil loss due to intensive rainfall may help in predicting long-term soil erosion rate in order to implement efficient soil conservation management. An analysis on a sub-hourly basis was carried out using the SWAT model.
>
> CONCLUSIONS Various combinations for climate change (intensity and distribution of rainfall events), land use change, and conservation measures were evaluated using the SWAT model.

In the first sentence of Chiara's Abstract she gives more details about what she did during her research. In the second sentence she also provides more background information. In the third sentence she justifies the reason for her research. And in the fourth sentence she indicates what model she used to carry out this research. Her Conclusions summarize all these four points in one sentence. Her Abstract and Conclusions then end as follows.

> ABSTRACT Our analysis highlighted three specific management strategies that may help in preventing or reducing cropland erosion. We predict that these strategies could reduce erosion by up to 25% in the studied area over the next ten years.
>
> CONCLUSIONS The result was a range of possible erosion values for the next ten years – the worst possible scenario indicated a possible erosion rate increase of up to 25%. In the light of these dramatic findings, we believe that our analysis may contribute to implementing ad-hoc land management strategies to reduce, or even completely prevent, cropland erosion. We hope that our findings may influence policy planning. Future work will entail refining our model by exploiting data from satellite sensors (e.g. InSAR).

The differences in the way that her two sections end are that her Conclusions:

- use phrases to describe the results that have a much stronger impact (*dramatic findings*, *even completely prevent*)
- make recommendations for policy change – this helps give the conclusions more substance and authority
- indicate future work and how Chiara plans to conduct such work

So what are the main differences between the Abstract and the Conclusions? The two sections have completely different purposes. The Abstract is like an advertisement for your paper – it has to attract the reader's attention. On the other hand, the Conclusions section is designed to remind readers of the most salient points of your paper. However, the Conclusions also have to add value. This added value is typically contained in the recommendations, implications and areas for future research.

In any case, it is a good idea to revise the Abstract and Conclusions together, and even shift information from one to the other.

Inevitably there will be some overlap between the two sections, but this is both accepted practice and inevitable. An analysis of the Chiara's Abstract and Conclusions, highlights that:

- they are similar in length: Abstract (152 words) and Conclusions (125 words) – these relative lengths are fairly typical in research papers
- each contains at least 20% different vocabulary – there are 34 words in the Abstract that do not appear in the Conclusions, and 33 words in the Conclusions that do not appear in the Abstract
- words that are unique to the Conclusions include words that indicate findings, possibility and the future (*believe*, *could, findings, help, planning, policy, predict, refining, result will*) and specific words (*EU, InSAR, satellite, Trasubbie*), and emotive words (*completely, dramatic, worst*)

18.4 How can I differentiate my Conclusions from my Introduction and from the last paragraph of my Discussion?

The same comments made in Sect. 18.3 regarding the difference between the Abstract and the Conclusions, are also substantially the same as for the Introduction, so they are not worth repeating.

If your journal has a separate section for Conclusions, i.e. the conclusions are not included in the Discussion, then it may be best to shift any overall conclusions you may have made in your Discussion into your Conclusions. This means that the final paragraph of your Discussion may just be a conclusion regarding one specific point, rather than an overall summary of the whole paper. See Sects. 17.5 and 17.6 for more on this aspect.

18.5 I don't have any clear Conclusions, what can I do?

Sometimes it is impossible to leave the reader with clear conclusions regarding the contribution of your work – maybe your method turned out to be inappropriate and your results were not as brilliant as you were hoping for! In such cases simply say what you have learned about the problem and then suggest possible lines of future research. Such a final section is generally entitled Concluding Remarks.

If you don't have any clear conclusions, it is important not to present your findings in an exaggerated light or to say something uninteresting or irrelevant. Readers may

still be able to benefit from what you found (or equally important, did not find). In order to present inconclusive conclusions you may benefit from using hedging devices (Sects. 9.2–9.6).

Here are some examples of authors admitting that their work did not achieve all that they had hoped for. In some cases readers are immediately warned of this 'failure' through the use of the words highlighted in italics.

Unfortunately, we could not assess how much of the difference in outcome was due to ..

When results are compared across different components, the confidence intervals overlap, and we have no conclusive evidence of differences in ...

Although some progress has been made using our model, this incremental approach provides only a partial answer

Unfortunately this trial had too few subjects to achieve sufficient power and had a low …

It is also unclear what conclusion should be drawn …

Regrettably, we did not have the means to …

To make your Conclusions not sound too negative, you can add some hope for the future.

Although it is too early to draw statistically significant conclusions, two patterns seem to be emerging …

However, more definite conclusions will be possible when ...

Nevertheless, our study confirms recent anecdotal reports of …

Despite this, our work provides support for …

In any case, we believe that these preliminary results indicate that …

Again, the first words of the sentence alert the reader that you are now going to qualify the negative stuff you said before by offering some optimism. You could also use some conditional sentences to show what might have been possible if you had had different circumstances, or what might be possible in the future.

If we had managed to … then we might have been able to …

If we manage to … then we might be able to.

18.6 How can I end my Conclusions?

Once you have summarized your work and dealt with any limitations, there are three typical ways to end your Conclusions. You can use one or more of these ways.

The first is to show how your work could be applied in another area.

Our findings could be applied quite reliably in other engineering contexts without a significant degradation in performance.

These findings could be exploited in any situation where predictions of outcomes are needed.

Our results could be applied with caution to other devices that …

Note how the above phrases all make use of *could* as a hedging device (Sect. 9.6).

You might however like to say where they could not be applied for the moment.

However, it remains to be further clarified whether our findings could be applied to …

Further studies are needed to determine whether these findings could be applied to components other than those used for …

The second typical ending is to suggest future work. There is some general agreement that the use of *will* refers to your own planned work, and that *should* refers to work that you believe could be addressed by the general community. Thus the following represent the authors' plans:

One area of future work *will* be to represent these relationships explicitly …

Future work *will* mainly cover the development of additional features for the software, such as …

Future work *will* involve the application of the proposed algorithm to data from …

On the other hand, these examples show possible lines of research for anyone in this particular field:

Future work *should* give priority to (1) the formation of X; (2) the interaction of Y; and (3) the processes connected with Z.

Future work *should* benefit greatly by using data on …

The third way to end your Conclusions is to make a recommendation. The difficulty in making suggestions and recommendations is just in the grammatical construction. The examples below highlight a construction that may not exist in your language.

S1. We suggest that policy makers *should give* stakeholders a greater role in …

S2. We suggest that policy makers *give* stakeholders a greater role in …

S3. We suggest that the manager *giv*e stakeholders a greater role in …

S4. We recommend that stakeholders *should be given* a great role in …

S5. We recommend that stakeholders *be given* a greater role in …

The construction is thus:

to *recommend* (*suggest, propose*) + *that* + someone or something + *should* (optional) + infinitive (without *to*) + something

The only difference between S1 and S2, and between S4 and S5 is the use and non-use of *should* - the meaning is identical. S3 highlights that the form of the second verb does not change – in fact it is an infinitive form (or if you a language

expert, the present subjunctive). This means that in correct English no third person *–s* is required, so *we suggest that the manager gives* is incorrect (but still quite common). S4 and S5 use the passive infinitive (*be*) + past participle (*given*).

18.7 What tenses should I use?

Many tenses and constructions are used in the Conclusions – the future, conditionals, modal verbs etc. For details on how to use these forms see the companion volume English for Research: Usage, Style, and Grammar.

One distinction that many authors make is between what they did during the research (SIMPLE PAST) and what they did during the writing process of the manuscript (PRESENT PERFECT).

> We *have described* a method to extract gold from plastic. We *used* this method to extract 5 kg of gold from 50 kg of plastic. We *found* that the optimal conditions for this process were …

The first verb (*have described*) says what the authors have done in the paper, whereas the second and third verbs (*used, found*) say what they did in the laboratory (i.e. a finished action).

The following two sentences are incorrect because they use the PRESENT SIMPLE instead of the PRESENT PERFECT:

S1. *In this paper we *consider* the robust design of an extractor for removing gold from plastic.

S2. *In this study, it *is demonstrated* that by using an ad hoc extractor gold can be easily removed from plastic.

S1 and S2 would be correct in the Abstract or Introduction.

18.8 Summary: How can I assess the quality of my Conclusions?

To make a self-assessment of your Conclusions, you can ask yourself the following questions.

- Is what I have written really a Conclusions section? (If it is more than 200–250 words, then it probably isn't – it needs to be much shorter)
- If the conclusions are included in the Discussion, have I clearly signaled to the reader that I am about to discuss my conclusions (e.g. by writing *In conclusion …*)?
- Have I given a maximum of one line to comments related to descriptions of procedures, methodology, interviews etc.? (Generally such comments are not needed at all, unless the primary topic of your paper is the methodology itself)
- Have I avoided cut and pastes from earlier sections? Do my Conclusions differ appropriately from my Abstract, Introduction and final paragraph of my Discussion?
- Are my Conclusions interesting and relevant?
- Have I given my Conclusions as much impact as possible and have I avoided any redundant expressions?
- Have I avoided any unqualified statements and conclusions that are not completely supported?
- Is my work as complete as I say it is? (i.e. I am not trying to get priority over other authors by claiming inferences that cannot really be drawn at this stage)
- Have I introduced new avenues of potential study or explained the potential impact of my conclusions? Have I ensured that I have only briefly described these future avenues rather than getting lost in detail?
- Are the possible applications I have suggested really feasible? Are my recommendations appropriate?
- Have I used tenses correctly? PRESENT PERFECT (to describe what you have done during the writing process), PAST SIMPLE (what you did in the lab, in the field, in your surveys etc.)

In addition, you should look at the summary questions for the Discussion (Sect. 17.14), as these may also be helpful in deciding whether your Conclusions will have the necessary impact on your readers.

Chapter 19
Useful Phrases

Why is this chapter important?

Many non-native researchers begin their writing career by reading extensively about their topic in English, and noting down useful generic phrases that they can then 'paste' into their own work (see Chap. 1). You can use such phrases as a template / structure for your paper into which you insert your own data. You at least know that these ready-made phrases are in correct English. You do not risk being accused of plagiarism (see Chap. 10) because of the very generic nature of the phrases.

This chapter presents lists of frequently used phrases that have a general acceptance in all disciplines that you can use in specific sections of your paper. This means that they are phrases that referees and readers frequently encounter, and this will help to describe your findings using conventional language. This is important as referees and readers do not want to be disturbed by strange expressions that could easily be replaced by one of the standard phrases given in this chapter.

The lists are not comprehensive and you should try to add other useful phrases that frequently occur in your field.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_19, © Springer Science+Business Media, LLC 2011

What the experts say

As with most types of language production, academic writing is characterized by a significant number of preconstructed or semi-preconstructed phrasal elements. These are mostly learnt and retrieved from memory as wholes. For non-native speakers, lists of these elements, organised according to the function they serve in text, can play a useful role in supporting and developing good writing.

Dr John Morley, Director of University-wide Language Programmes at the University of Manchester, and author of the "Phrase Bank"

When your language skills are not perfect, organizing your information in a conventional way and using conventional language are very important.

Hilary Glasman-Deal, trainer in science research writing at Imperial College London, and author of "Science Research Writing For Non-Native Speakers of English"

I learned to write engineering papers in English by collecting useful phrases from every article in English that I read. I have used these phrases throughout my career in academia, and I believe that they have served both me and my students very well.

Professor Antonio Strozzi, author of "How to Write a Technical Paper in English - A Repertoire of Useful Expressions"

19.1 Index of Useful Phrases

1. Establishing why your topic (X) is important
2. Outlining the past-present history of the study of X (no direct references to the literature)
3. Outlining the possible future of X
4. Indicating the gap in knowledge and possible limitations
5. Stating the aim of your paper and its contribution
6. Explaining the key terminology in your field
7. Explaining how you will use terminology and acronyms in your paper
8. Giving the structure of paper - what is and is not included
9. Giving general panorama of past-to-present literature
10. Reviewing past literature
11. Reviewing subsequent and more recent literature
12. Reporting what specific authors of have said
13. Mentioning positive aspects of others' work
14. Highlighting limitations of previous studies - authors not mentioned by name
15. Highlighting limitations of previous studies - authors mentioned by name
16. Using the opinions of others to justify your criticism of someone's work
17. Describing purpose of testing / methods used
18. Outlining similarities with other authors' models, systems etc.
19. Describing the apparatus and materials used and their source
20. Reporting software used
21. Reporting customizations performed
22. Formulating equations, theories and theorems
23. Explaining why you chose your specific method, model, equipment, sample etc.
24. Explaining the preparation of samples, solutions etc.
25. Outlining selection procedure for samples, surveys etc.
26. Indicating the time frame (past tenses)
27. Indicating the time frame in a general process (present tenses)
28. Indicating that care must be taken
29. Describing benefits of your method, equipment etc.
30. Outlining alternative approaches
31. Explaining how you got your results
32. Reporting results from questionnaires and interviews
33. Stating what you found
34. Stating what you did not find
35. Highlighting significant results and achievements
36. Stating that your results confirm previous evidence
37. Stating that your results are in contrast with previous evidence
38. Stating and justifying the acceptability of your results
39. Expressing caution regarding the interpretation of results
40. Outlining undesired or unexpected results
41. Admitting limitations
42. Explaining and justifying undesired or unexpected results
43. Minimizing undesired or unexpected results
44. Expressing opinions and probabilities
45. Announcing your conclusions and summarizing content
46. Restating the results (Conclusions section)
47. Highlighting achievements (Conclusions section)
48. Highlighting limitations (Conclusions section)
49. Outlining possible applications and implications of your work
50. Future work already underway or planned by the authors
51. Future work proposed for third parties to carry out

52. Acknowledgements
53. Referring to tables and figures, and to their implications
54. Making transitions, focusing on a new topic
55. Referring backwards and forwards in the paper
56. Referring back to your research aim
57. Referring outside the paper

19.2 How to use the Useful Phrases

Where possible the order of the useful phrases given in this chapter reflects the order that they might appear in a paper, and within a section. Thus the phrases should help you to structure each section.

The same phrases may be needed in several sections of your paper. Below I have suggested which phrases you might need in each section.

Abstract	1, 5 and possibly 2–4
Introduction	1–8, 9–16
Literature review	4, 9–16
Methods	17–30
Results	29–40
Discussion	35–45
Conclusions	45–51
Acknowledgements	52

There are also five other subsections (53–57) on how to make references to other parts of your paper and to documents outside your paper.

Words and phrases between slashes (/) indicate various ways the sentence could be composed. The ways suggested are not exhaustive. A slash does not always indicate synonymous expressions, but simply words and phrases that are likely to be used in a similar context. You are advised to consult a bilingual dictionary to help you to differentiate the differences between the words and phrases given.

In some cases words and phrases have an identical meaning. For example, when used with reference to figures and tables, there is little, if any difference in meaning between verbs such as *shows, reports* and *highlights*. However, some words apparently seem to be synonyms, but may have specific or subtle differences in your field. For example, the following groups of generally have distinct meanings:

argue, assert, claim, state

assume, hypothesize, suggest

find, discover

demonstrate, prove, test

If you have checked that a word or phrase really has the same meaning, I suggest you choose the shortest option. For example choose:

Since x = y …

Although x = y …

Rather than

Given the fact that x = y …

Despite the fact that x = y …

Notwithstanding the fact that x = y …

Of course, if you need to use the same type of phrase on several occasions, then you can use the longer constructions too.

Your choice of phase will often depend on what style of writing you are using: the passive (e.g. *it was found*) or personal forms (i.e. *we, I*). This choice will itself depend on what your journal requires (see Sect. 7.1). In any case, if you have opted for a personal style, I suggest that in any case you use some passive forms to create variety in your writing.

A very comprehensive collection of useful phrases plus related advice can be found at http://www.phrasebank.manchester.ac.uk/. The phrases were compiled by Dr John Morley, Director of University-wide Language Programmes at the University of Manchester. Some of the phrases below have been adapted from that collection.

Finally, if you have the electronic version of this book, you can easily make searches within this chapter. You can also search and check for phrases using Google Scholar.

1. Establishing why your topic (X) is important

   X is the main / leading / primary / major *cause of* ..

   Xs are a common / useful / critical *part of*…

   Xs are among the most widely used / commonly discussed / well-known / well-documented / widespread / commonly investigated *types of* …

   X is recognized as being / believed to be / widely considered to be *the most important* …

   It is well known / generally accepted / common knowledge *that X is* …

   X is increasingly becoming / set to become *a vital factor in* …

   Xs are undergoing a revolution / generating considerable interest *in terms of* …

   Xs are attracting considerable / increasing / widespread *interest due to* …

   X has many uses / roles / applications *in the field of* …

   A striking / useful / remarkable *feature of* …

   The main / principal / fundamental *characteristics of X are:*

   X accounts / is responsible *for*

2. Outlining the past-present history of the study of X (no direct references to the literature)

   Last century X was considered to be / viewed as / seen as *the most* …

   Initial / Preliminary / The first *studies of X considered it to be*

Traditionally X / In the history of X, *the focus has always been …*

Scientists / Researchers / Experts *have always seen X as …*

Until now / For many years / Since 1993 *Xs have been considered as …*

X has received much attention in the last two years / in the past decade / over the last two decades …

For the past five years / Since 2011 *there has been a rapid rise in the use of Xs*

The last two years have witnessed / seen *a huge growth in X …*

The *past decade* / *last year* has seen a renewed importance in X …

Recent developments in / findings regarding *X have led to …*

X has become a central / an important / a critical *issue in …*

3. Outlining the possible future of X

The next decade is likely to see / witness *a considerable rise in X*

In the next few years X will become / is likely to have become

Within the next few years, X is set / destined / likely *to become an important component in …*

By 2025 / Within the next ten years, *X will have become …*

X will soon / shortly / rapidly / inevitably *be an issue that …*

4. Indicating the gap in knowledge and possible limitations

Few researchers have addressed the problem / issue / question *of …*

Previous work has only focused on / been limited to / failed to address …

A basic / common / fundamental / crucial / major *issue of …*

The central / core *problem of*

A challenging / An intriguing / An important / A neglected *area in the field of …*

Current solutions to X are inconsistent / inadequate / incorrect / ineffective / inefficient / over-simplistic / unsatisfactory

Many hypotheses regarding X appear to be ill-defined / unfounded / not well grounded / unsupported / questionable / disputable / debatable

The characteristics of X are not well understood / are misunderstood / have not been dealt with in depth.

It is not yet known / has not yet been established *whether X can do Y.*

X is still poorly / not widely *understood.*

X is often impractical / not feasible / costly …

Techniques to solve X are computationally demanding / subject to high overheads / time consuming / impractical / frequently unfeasible.

A major defect / difficulty / drawback / disadvantage / flaw *of X is …*

One of the main issues in our knowledge of / what we know about *X is a lack of …*

This particular / specific *area of X* has been overlooked / has been neglected / remains unclear …

Despite this interest, no one to the best of our knowledge / as far as we know *has studied …*

Although this approach is interesting, it suffers from / fails to take into account / does not allow for …

In spite of / Despite *its shortcomings, this method has been widely applied to …*

However, there is still a need for / has been little discussion on …

Moreover, other solutions / research programs / approaches *have failed to provide …*

Most studies have only focused / tended to focus *on …*

To date / Until now *this methodology has only been applied to …*

There is still some / much / considerable *controversy surrounding …*

There has been some disagreement concerning / regarding / with regard to *whether*

There is little / no general agreement *on …*

The community has raised some issues / concerns *about …*

Concerns have arisen / been raised *which* question / call into question *the validity of …*

In the light of recent events in x, there is now some / much / considerable *concern about …*

5. Stating the aim of your paper and its contribution

In this report / paper / review / study *we …*

This paper outlines / proposes / describes / presents *a new approach to …*

This paper examines / seeks to address / focuses on / discusses / investigates *how to solve …*

This paper is an overview of / a review of / a report on / a preliminary attempt to …

The present paper aims to validate / call into question / refute *Peng's findings regarding …*

X is presented / described / analyzed / computed / investigated / examined / introduced / discussed *in order to …*

The aim of our work / research / study / analysis *was to* further / extend / widen / broaden *current knowledge of …*

Our knowledge of X is largely based on very limited data. The aim of the research was thus / therefore / consequently *to*

The aim of this study is to study / evaluate / validate / determine / examine / analyze / calculate / estimate / formulate …

This paper calls into question / takes a new look at / re-examines / revisits / sheds new light on …

With this in mind / Within the framework of these criteria / In this context *we tried to …*

We undertook this study / initiated this research / developed this methodology *to …*

We believe that we have found / developed / discovered / designed *an innovative solution to …*

We describe / present / consider / analyze *a* novel / simple / radical / interesting *solution for …*

6. Explaining the key terminology in your field

The term 'X' is generally understood to mean / has come to be used to refer to / has been applied to …

In the literature, *X* usually refers / often refers / tends to be used to refer *to …*

In the field of X, several / various / many *definitions of Y can be found.*

The term X is / was / has been *used by Molotov [2011] to refer to …*

Molotov uses the term X [2011] to refer to / denominate …

X is defined by Peng [1990] to refer to / to mean …

Vitous [2015] has provided / put forward / proposed *a new definition of X, in which …*

X is defined / identified / described *as … [Njimi 2004].*

In the literature there seems to be no general definition of X / a general definition of X is lacking / there is no clear definition of X.

Several authors have attempted to define X, but as yet / currently / at the time of writing *there is still no accepted definition.*

In broad / general *terms*, *X* is / can be defined as *a way to …*

The broad / general / generally accepted *use of the term X refers to …*

X is sometimes *equated with / embodies* a series of …

X, Y and Z are three kinds / types / categories / classes *of languages*.

There are three kinds of languages: / The three kinds of languages are: / Languages can be divided into three kinds: *X, Y and Z.*

7. Explaining how you will use terminology and acronyms in your paper

   The acronym PC stands for / denotes …

   The subjects (*henceforth named / hereafter* 'X') are…

   The subject, which we shall call / refer to *as 'X', is …*

   Throughout this paper / section *we use the terms 'mafia' and 'the mob' interchangeably*, following / in accordance with *the practice of this department where this study was conducted.*

   The fonts, i.e. / that is to say *the form of the characters, are of various types*.

   There are three different types, namely / specifically: *X, Y and Z.*

   Throughout the / In this *paper we* use / will use *the term X to refer to …*

   In this chapter X is used / will be used to *refer to …*

   In this paper the standard meaning of X is / will be *used ..*

   This aspect is / will be dealt *with in more detail in Sect. 2.*

   We will see / learn / appreciate *how relevant this is in the next subsection*.

8. Giving the structure of paper - what is and is not included

   This paper is organized as follows / divided into five sections.

   The first section / Section 1 *gives a brief overview of …*

   The second section examines / analyses …

   In the third section a case study is presented / analyzed …

   A new methodology is described / outlined *in the fourth section …*

   We / I *propose a new procedure in Section 4*.

   Some / Our *conclusions are drawn in the final section.*

   This paper / chapter / section / subsection *begins by examining …*

   The next chapter looks at / examines / investigates *the question of …*

   Problems / Questions / Issues *regarding X are discussed in later sections.*

   A discussion of Y is / falls outside *the scope of this paper.*

   For reasons of space, Y is not addressed / dealt with / considered *in this paper*.

9. Giving general panorama of past-to-present literature

   There is a considerable / vast *amount of literature on …*

   In the literature there are many / several / a surprising number of / few *examples of …*

   What we know / is known *about X is largely based on …*

   Much / Not much / Very little *is known about …*

   Many / Few *studies have been published on …* [Ref]

   Various approaches have been proposed / put forward / suggested / hypothesized *to solve this issue [Ref].*

   X has been identified / indicated *as being …* [Ref]

   X has been shown / demonstrated / proved / found *to be … [Ref]*

   X has been widely investigated / studied / addressed *… [Ref]*

   Xs have been receiving / gaining *much attention due to …*

   In the traditional / classical *approach, X is used to …*

   In recent years there has been considerable / growing *interest in … [Ref*]

A growing body of literature has examined / investigated / studied / analyzed / evaluated … *[Ref]*

Much work on the potential of X has been carried out [Ref], yet / however *there are still some critical issues … [Ref]*

10. Reviewing past literature

In their seminal / groundbreaking / cutting edge *paper of 2001, Peters and Jones …*

Initial / Preliminary *work in this field focused primarily on …*

Some preliminary work was carried out in the early 1990s / several years ago …

Doyle in 2000 was among / one of *the first to …*

The first investigations into / studies on *X found that …*

The first systematic study / report *on X was* carried out / conducted / performed *in 1995 by …*

An increase in X was first noted / reported / found *by …*

11. Reviewing subsequent and more recent literature

Experiments on X were conducted / carried out / performed on *X in 2009 by a group of researchers from …*

In a major advance in 2010, Berlusconi et al. surveyed / interviewed …

Jeffries and co-workers [2011] measured / calculated / estimated …

In [67] the authors investigated / studied / analyzed …

A recent review of the literature on this topic / subject / matter / area *[2012] found that …*

A number / An increasing number *of studies have found that …*

Since 2011 / In the last few years*, much more information on X has become available …*

Several studies, for example / instance *[1], [2], and [6],* have been carried out / conducted / performed *on X.*

More recent evidence [Obama, 2013] shows / suggests / highlights / reveals / proposes *that …*

It has now been suggested / hypothesized / proposed / shown / demonstrated *that … [Cosimo 2010]*

Many attempts have been made [Kim 2009, Li 2010, Hai 2011] in order to / with the purpose of / aimed at …

12. Reporting what specific authors of have said

In her analysis / review / overview / critique *of X, Bertram [2] questions the need for …*

In his introduction to / seminal article on / investigation into *X, Schneider [3] shows that …*

*Dee [*4] developed / reported *on a new method for X and concluded that …*

Southern's group [5] calls into question some past assumptions / hypotheses / theories *about X.*

Burgess [6], an authority on X, notes / mentions / highlights / states / affirms *that …*

She questions / wonders / considers / investigates *whether [or not] X can …*

He traces the advances in / development of / history of / evolution of *X*

They draw our attention to / focus on *X.*

They make / draw *a distinction between …*

He claims / argues / maintains / suggests / points out / underlines *that …*

She concludes / comes to the conclusion / reaches the conclusion *that …*

She lists / outlines / describes / provides *several reasons for …*

Her theory / solution / proposal / method / approach *is based on …*

13. Mentioning positive aspects of others' work

    Smith's [22] use of X is fully justified / very plausible / endorsed by experience.

    Kamos's [23] assumptions seem to be realistic / well-founded / well-grounded / plausible / reasonable / acceptable.

    The equations given in [24] are accurate / comprehensive …

    It has been suggested [25] that … and this seems to be a reliable / useful / innovative *approach* …

14. Highlighting limitations of previous studies - authors not mentioned by name

    Research has tended to focus on X rather than Y. An additional problem is that / Moreover *X is* …

    The main limitation / downside / disadvantage / pitfall / shortfall *of X is …*

    One of the major drawbacks to adopting / using / exploiting *this system is …*

    This is something of a pitfall / disadvantage …

    A well-known / major / serious *criticism of X is* …

    A key problem with much of the literature on / regarding / in relation to *X is that* …

    This raises many questions *about / as to / regarding* whether X should be used for …

    One question / issue *that needs to be* asked / raised *is* …

    Unfortunately, it does not / fails to / neglects to *explain why* …

    This method suffers from a number / series / plethora *of pitfalls*.

    There is still considerable ambiguity / disagreement / uncertainty *with regard to* …

    Many experts contend, however / instead / on the other hand, *that this evidence is not conclusive.*

    A related hypothesis holds / maintains *that X is equal to Y,* suggesting / indicating *that …*

    Other observations indicate / would seem to suggest *that this explanation is insufficient* …

15. Highlighting limitations of previous studies - authors mentioned by name

    Peng [31] claimed / contended *that X is … but she failed to provide adequate proof of this finding*.

    Peng's findings do not seem / appear *to support his conclusions*.

    This has led authors such as / for example / for instance *Mithran [32], Yasmin [34] and Hai [35] to investigate ..*

    The shortcomings / pitfalls / flaws *of their method have been clearly recognized*.

    A serious weakness / limitation / drawback *with this argument, however, is that …*

    Their approach is not well suited to / appropriate for / suitable for …

    The main weakness in their study is that they make no attempt to … / offer no explanation for … / they overlook …

    Their experiments were marred / flawed / undermined *by X*.

    X is the major flaw in / drawback to / disadvantage of *their experiments*.

    The major defect in their experiments is that they entail tedious / repetitive / time-consuming / laborious / labor-intensive *calculations with regard to …*

    Such an unreasonable / unjustified / inappropriate / unsuitable / misleading assumption *can lead to* serious / grave *consequences with regard to …*

    Their claims seem to be somewhat exaggerated / inaccurate / unreliable / speculative / superficial …

In our view, their findings are only conjectures / speculations *based on* unjustified / implausible / unsatisfactory / ambivalent / unsubstantiated *assumptions*.

Their paper / work / study / research / approach / findings / results *might have been more* interesting / innovative / useful / convincing / persuasive if …

Their attempts to do X are cumbersome / unnecessarily complicated / financially unfeasible …

Their explanations are superficial / impenetrable / doubtful / confusing / misleading / irrelevant …

Another / An additional *weakness is* …

An even greater source of concern / issue / problem *is* …

16. Using the opinions of others to justify your criticism of someone's work

As mentioned by Burgess [2011], Henri's argument / approach / reasoning *relies too heavily on* …

As others have highlighted [34, 45, 60], Ozil's approach raises many doubts / is questionable …

Several authors / experts / researchers / analysts *have* expressed doubts about / called into question / challenged *Guyot on the grounds that …..*

Marchesi [2010] has already noted an inconsistency with Hahn's claim / methodology / method / results / approach …

Friedrich's approach [2013] has not escaped criticism / been subjected to much criticism *and has been* strongly / vigorously *challenged* …

Many experts now contend / believe / argue *that rather than using Pappov's approach it might be more useful to* …

Their analysis has not found / met with / received *general acceptance* …

Some recent criticisms of / critical comments on *Kim's work are summarized in [25].*

The most well-known critic of Sadie's findings is … who argued / proposed / suggested *that an alternative explanation* might be that / could be found in …

17. Describing purpose of testing / methods used

In order to identify / understand / investigate / study / analyze *X* …

To enable / allow *us to … , we …*

To see / determine / check / verify / determine *whether* …

To control / test *for X, Y was done*.

So that we could / would be able to *do X, we …*

In an attempt / effort *to do X, we …*

X was done / We did X *in order to* …

18. Outlining similarities with other authors' models, systems etc.

The set up we used can be found / is reported / is detailed *in [Ref 2].*

Our experimental set up bears a close resemblance to / is reminiscent of / is based on / is a variation on / was inspired by / owes a lot to / is more or less identical to / is practically the same as *the one proposed by Smith [2014].*

We used a variation of Smith's procedure. In fact / Specifically, *in our procedure we …*

Our steps proceed very much in the same way as / follow what is *indicated in [Ref. 2]. First, …*

The procedure used is as described / explained / reported / proposed *by Sakamoto [2013].*

The method is in line with a variation of / essentially the same as *that used by Kirk [2009] with some* changes / modifications / alterations / adjustments.

We refined / altered / adapted / modified / revised *the method* used / reported / suggested / explained / proposed / put forward *by Bing [2012].*

Our technique was loosely / partially / partly / to some extent *based on …*

More details can be found / are given *in our previous paper [35].*

This component is fully compliant with international norms / regulations / standards.

19. Describing the apparatus and materials used and their source

The instrument used / utilized / adopted / employed *was …*

The apparatus consists of / is made up of / is composed of / is based on …

The device was designed / developed / set up *in order to …*

X incorporates / exploits / makes use of *the latest technological advances*.

The system comes complete / is equipped / is fully integrated / is fitted *with a …*

It is mounted on / connected to / attached to / fastened to / fixed to / surrounded by / covered with / integrated into / embedded onto / encased in / housed in / aligned with …

It is located in / situated in / positioned on ….

X was obtained from / supplied by *Big Company Inc*.

X was kindly provided / supplied *by Prof Big.*

20. Reporting software used

The software application / program / package *used to analyze the data was SoftGather (Softsift plc, London).*

The data were obtained / collected *using SoftGather.*

Data management / analysis *was performed* by / using *SoftGather.*

X was carried out / performed / analyzed / calculated / determined *using SoftGather*.

Statistical significance was analyzed by using / through the use of *SoftGather.*

We used commercially available software / a commercially available software package.

Free software, downloaded from www.free.edu, was used / adopted *to …*

21. Reporting customizations performed

X was tailored / customized *for use with …*

X can easily be customized / adapted / modified *to suit all requirements*.

Measurements were taken using purpose-built / custom-built / customized *equipment*.

The apparatus was adapted as in [Ref] / in accordance with [Ref] / as follows:

The following changes / modifications *were made:*

The resulting ad hoc device can / is able to / has the capacity to …

22. Formulating equations, theories and theorems

This problem can be outlined / phrased / posed *in terms of …*

The problem is ruled by / governed by / related to / correlated to …

This theorem asserts / states *that …*

The resulting integrals / solution to X *can be expressed as …*

… where T stands for / denotes / identifies / is an abbreviation for *time*.

By substituting / Substituting / Substitution *into …*

Combining / Integrating / Eliminating .. *we have that: …*

Taking advantage of / Exploiting / Making use of *X, we …*

On combining this result with X, we deduce / conclude *that …*

Subtracting X from Y, we have that / obtain / get …

Equation 1 shows / reveals *that*

This gives the formal solution / allows a formal solution to be found …

It may easily / simply *verified that …*

It is straightforward / easy / trivial *to verify that …*

For the sake of simplicity / reasons of space*, we*

23. Explaining why you chose your specific method, model, equipment, sample etc.

The aim / purpose *of X is to do Y.* Consequently we / As a result we / Therefore we / We thus …

This method / model / system *was chosen because it is one of the most* practical / feasible / economic / rapid *ways to …*

We chose this particular apparatus because / on account of the fact that / due to / since …

It was decided that the best procedure / method / equipment *for this* investigation / study *was to …*

An X approach was chosen / selected *in order to …*

The design of the X was based on / is geared towards …

We opted for / chose *a small sample size* because / due to / on the basis of …

By having / By exploiting / Through the use of *X, we were able to …*

Having an X enabled us to / allowed us to / meant that we could *do Y.*

24. Explaining the preparation of samples, solutions etc.

We used reliable / innovative / classic / traditional *techniques based on the recommendations of …*

Xs were prepared as described by / according to / following *Jude [2010*].

Xs were prepared in accordance with / in compliance with / as required by….

Y was prepared using the same / a similar *procedure as for X.*

All samples were carefully / thoroughly *checked for …*

X was gradually / slowly / rapidly / gently *heated*

The final / resulting *solutions contained …*

This was done by means of / using / with *a calculator.*

25. Outlining selection procedure for samples, surveys etc.

The traditional / classical / normal / usual *approach to sample collection is to …*

The criteria / reasons *for selecting Xs were*:

The sample was selected / subdivided *on the basis of X and Y.*

The initial sample consisted of / was made up / was composed of …

Approximately / Just over / Slightly under *a* half / third / quarter *of the sample were …*

A total of 1234 Xs were recruited for this study / this survey / for interviews.

At the beginning of the study, all of the participants / subjects / patients *were aged ……*

In all cases patients' / subjects' / participants' *consent was obtained.*

Interviews were performed / conducted / carried out *informally*

The interviewees were divided / split / broken down *into two groups* based on / on the basis of …

26. Indicating the time frame (past tenses)

Initial studies were made / performed / done / carried out / executed *using the conditions described above* over / for *a period of …*

X was collected / used / tested / characterized / assessed *during the* first / initial *step*.

Prior to / Before doing *X, we did Y*.

First we estimated / determined *the value of X*, then / subsequently *we* studied / analyzed / evaluated *Y*.

Once / As soon as / After X *had been done, we then did Y*.

The levels were thus / consequently / therefore *set at …*

After / Afterwards / Following this, *X was subjected to Y.*

The resulting / remaining *Xs were then …*

The experiment was then repeated / replicated *under conditions in which …*

Finally, independent / separate / further / additional *tests were performed on the …*

27. Indicating the time frame in a general process (present tenses)

In the first step / During the first phase / In the initial stage *of the process …*

Once / As soon as / After *X has been done, we can then do Y.*

This sets the stage / We are now ready *for the next step.*

At this point / Now *X can be …*

After / When / As soon as *these steps have been carried out, X …*

With the completion of these steps / When these steps have been completed, *we are now ready to …*

This condition cannot be reached until / unless *X has been …*

When / As soon as *X is ready, the final adjustments can be made*.

The completed X can now / then / subsequently *be used to …*

By reducing the amount of X / If the amount of X is reduced, *Y can then be done.*

To reduce the risk of Y, place / The risk of X can be reduced by placing *all the Xs in a container.*

The experiment proceeds / continues *following the steps outlined below*.

28. Indicating that care must be taken

To do this entails / involves / requires *doing X.*

It is seldom / rarely / usually / generally / often / always *practical to …*

Considerable / Great *care are must be* taken / exercised *when …*

A great deal of / Considerable *attention must be paid when …*

Extreme caution must be taken / used *when …*

29. Describing benefits of your method, equipment etc.

This method represents a viable / valuable / useful / groundbreaking / innovative *alternative to …*

This equipment has the ability / capacity / potential *to outperform all previous Xs*.

This apparatus has several / many *interesting* features / characteristics.

Our method has many interesting / attractive / beneficial / useful / practical / effective / valuable *applications*.

Of particular / major / fundamental *interest is …*

The key / basic / chief / crucial / decisive / essential / fundamental / important / main / major / principal *advantages are*:

Our procedure is a clear improvement / advance *on current methods*.

We believe this solution will aid / assist *researchers to …*

This solution improves on / enhances / furthers / advances *previous methods by …*

The benefits / advantages *in terms of X far outweigh the disadvantages with regard to Y.*

30. Outlining alternative approaches

A less lengthy / time-consuming / cumbersome / costly *approach is …*

A neater / more elegant / simplified / more practical *solution for this problem …*

An alternative solution, though with high overheads / slightly more complicated / less exhaustive *is …*

One / One possible / A good way *to avoid the use of X is to use Y instead.*

31. Explaining how you got your results

To assess X / evaluate X / distinguish between X and Y, *Z was used.*

X analysis was used to test / predict / confirm *Y.*

Changes in X were identified / calculated / compared *using …*

The correlation / difference *between X and Y was tested.*

The first set of analyses investigated / examined / confirmed / highlighted *the impact of …*

32. Reporting results from questionnaires and interviews

Of the study population / initial sample / initial cohort, *90 subjects completed and returned the questionnaire.*

The response rate was 70% at / after / for the first *six months and …*

The majority of respondents / those who responded *felt that ….*

Over half / Sixty per cent *of those* surveyed / questioned *reported that …*

Almost / Just under / Approximately *two-thirds of the participants (64%)* said / felt / commented *that …*

Only / Just a small number / Fifteen per cent *of those interviewed* reported / suggested / indicated *that …*

Of the 82 subjects who completed the questionnaire / took part in the survey / agreed to participate, *just* under / over *half replied that ….*

A small minority of / Hardly any / Very few participants *(4%) indicated …*

In response to Question 1, most / nearly all / the majority *of those surveyed indicated that …*

When the subjects were asked about / questioned on *X the majority commented that ….*

The overall response to this question was surprisingly / unexpectedly / very / quite *negative.*

33. Stating what you found

These tests revealed / showed / highlighted *that …*

Strong / Some / No evidence *of X was found …*

Interestingly / Surprisingly / Unexpectedly, *for high values of X, Y was found ..*

There was a significant positive / no *correlation between …*

On average / Generally speaking / Broadly speaking, *we found values for X of …*

The average / mean *score for X was …*

This result is significant only / exclusively *at an X level.*

Further analysis / analyses / tests / examinations / replications *showed that …*

34. Stating what you did not find

No significant difference / correlation *was* found / identified / revealed / detected / observed / highlighted between ….

There were no significant differences between X and Y in terms of Z / with regard to Z / as far as Z is concerned.

The analysis did not show / reveal / identify / confirm *any significant differences between …*

None of these differences were / Not one of these differences was *statistically significant*.

Overall / Taken as a whole / Generally speaking / With a few exceptions, *our results show X did not affect Y*.

35. Highlighting significant results and achievements

The most striking / remarkable *result to emerge from the data is that …*

Interestingly / Curiously / Remarkably / Inexplicably, *this correlation is related to ….*

Significantly / Importantly / Crucially / Critically, *X is …*

The correlation between X and Y is interesting / of interest / worth noting / noteworthy / worth mentioning *because …*

The most surprising / remarkable / intriguing *correlation is with the …*

The single most striking / conspicuous / marked *observation to emerge from the data comparison was …*

It is interesting / critical / crucial / important / fundamental *to note that …*

We believe that / As far as we know / As far as we aware *this is the first time that X …*

We believe that / We are of the opinion that / In our view *the result emphasizes the validity of our model.*

This result has further strengthened our confidence in X / conviction that X is / hypothesis that X is …

Our technique shows a clear / clearly has an *advantage over …*

The importance of X cannot be stressed / emphasized *too much*.

This underlines / highlights / stresses / proves / demonstrates *just how important X is*.

The utility of X is thus underlined / highlighted / stressed / proved / demonstrated.

This finding confirms / points to / highlights / reinforces / validates *the usefulness of X as a …*

Our study provides additional support for / further evidence for / considerable insight into *X*.

These results extend / further / widen *our knowledge of X*.

These results offer compelling / indisputable / crucial / overwhelming / powerful / invaluable / unprecedented / unique / vital *evidence for …*

36. Stating that your results confirm previous evidence

Our experiments confirm / corroborate / are in line with / are consistent with *previous results [Wiley 2009].*

The values are barely / scarcely / hardly *distinguishable from [Li 2010] who …*

This value has been found to be / is *typical of X.*

This is in good agreement / in complete agreement / consistent *with …*

This fits / matches / concurs well with [*65] and also confirms our* earlier / previous *findings [39, 40, 41].*

This confirms / supports / lends support to / substantiates *previous findings in the literature …*

These values correlate favorably / satisfactorily / fairly well *with Svenson [2009] and further support the* idea / role / concept *of …*

Further tests carried out with X confirmed / corroborated / concurred with *our initial findings*.

As proposed / suggested / reported / indicated / put forward *by Dong [2011], the evidence we found points to …*

Our results share / have *a number of similarities with Claire et al.'s [2012] findings …*

37. Stating that your results are in contrast with previous evidence

It was found that X = 2, whereas / on the other hand *Kamatchi [2011] found that …*

We found much higher values for X than / with respect to *those reported by Pandey [2000].*

Although / Despite the fact that *Li and Mithran [2014] found that X = 2 we found that X = 3.*

In contrast to / contradiction with *earlier findings [Castenas, 2009], we …*

This study has not confirmed previous research on X. However / Nevertheless / Despite this, *it serves to …*

Even though these results differ from some published / previous / earlier *studies (Cossu, 2001; Triana, 2002), they are consistent with those of …*

Kosov et al. noted that x = y. Our results do not support / appear to corroborate / seem to confirm *their observation, in fact …*

Georgiev is correct to argue / propose / claim *that x = y. However, his calculation only referred to the limited case of …. and our conclusion of x = z, would thus seem to be* justified / justifiable / defensible / correct / acceptable / warranted.

Although our results differ slightly / to some extent / considerably *from those of Minhaz [2001], Erturk [2007], and Hayk [2014], it* can / could *nevertheless be argued that …*

Our findings do / The current study does *not support previous research in this area. In fact,* contrary to / unlike / in contrast with *what was previously thought, we found that …*

These findings refute / disprove / are in contradiction with / contrast with / significantly differ from *previous results reported in the literature*.

38. Stating and justifying the acceptability of your results

As expected / anticipated / predicted / forecast / hypothesized, *our experiments* show / demonstrate / prove *that …*

Our formula captures / reproduces *the response of …*

Apart from this slight discordance / discrepancy / disagreement / non-alignment, *the result is confirmation of …*

Despite / Notwithstanding *the lack of agreement, we believe our findings compare well with …*

Although / Even though / Despite the fact that *there was some inconsistency …*

There is satisfactory / good / exceptional / perfect *agreement between …*

No significant / substantial / appreciable / noteworthy *differences were found …*

Our findings appear to be well substantiated / supported *by …*

The number of Xs that confirmed our findings was appreciable / significant / substantial.

39. Expressing caution regarding the interpretation of results

Initially we thought that x was equal to y. However, a more careful analysis / closer inspection *revealed that …*

These results / data / findings *thus need to be interpreted with* caution / care / attention.

The conclusions of the review should be treated / interpreted / analyzed / read *with caution*.

However, due care / careful attention / extreme caution *must be* exercised / paid *in …*

Given that our findings are based on a limited number of Xs, the results from such analyses should thus / consequently / therefore *be treated with* considerable / the utmost *caution*.

Other researchers have sounded / We should sound *a note of caution with regard to such findings.*

40. Outlining undesired or unexpected results

As was / might have been *expected, our findings were often contradictory …*

Contrary to expectations / Unlike other research carried out in this area, *we did not find a significant difference between …*

Our results were disappointing / poor / inadequate / unsatisfactory / below expectations. *However, …*

Our study was unsuccessful / not successful *in proving that …*

Our research failed to account for / justify / explain / give an explanation for / give a reason for *the low values of …*

Surprisingly / Unfortunately / Disappointingly / Regrettably, *no* signs of X were / evidence for X was *found*.

What is surprising / we were surprised to find / we are unable to account for *is the fact that …*

A substantial / appreciable / noticeable *disagreement is evident.*

The Xs appear to be over-predicted / overestimated / overstated …

This number is slightly lower than the value we expected / anticipated / predicted *and there is certainly room for improvement.*

41. Admitting limitations

We aware that our research may have two limitations. The first is … The second is … These limitations highlight / reveal / underline / are evidence of *the difficulty of collecting data on ….*

It is plausible that a number of limitations may / might / could have *influenced the results obtained.* First / To begin with … An additional / Another *possible source of error is …*

Since / Given that / As *the focus of the study was on X …* there is a possibility / there is some likelihood / it is not inconceivable *that dissimilar evaluations would have arisen if the focus had been on Y.*

The restricted use of X could account for / be the reason for / explain why …

There are several sources for / causes of / reasons for *possible error.*

A major source of unreliability / uncertainty / contamination *is in the method used to …*

Unfortunately, it was not possible / we were unable *to investigate the significant relationships of X and Y further* because / due to the fact that *Z is …*

Inevitably / Not surprisingly / As expected / As anticipated, *there were some* discrepancies / inaccuracies / problems *due to …*

The performance was rather / slightly / a little *disappointing. This was probably as a result of …*

One downside / disadvantage / negative factor *regarding our methodology is that …*

Further data collection is required / would be needed *to determine exactly how X affects Y.*

42. Explaining and justifying undesired or unexpected results

It is very likely / probable / possible *that participants may have erroneously … and this may have* led to / brought about *changes in …*

The prime / primary / foremost *cause of the discrepancy is* due to / a result of / a consequence of *X.*

This apparent lack of correlation can be attributed to / explained by / justified by …

The reason for this rather contradictory result is still not entirely / completely *clear, but …*

There are several possible explanations for this result / finding / outcome.

These differences can be explained / justified / accounted for *in part by …*

It can thus be suggested / conceivably hypothesized / reasonably assumed *that …*

The unexpectedly high / low *level of X is* undoubtedly / certainly / without any doubt *due to …*

A possible / reasonable / satisfactory *explanation for X may be that ….*

Another possible explanation / rationalization / reason *for this is that …*

Clearly / Evidently / Naturally *there may be other possible explanations.*

This happened / occurred / may have happened / may have occurred *because we had not examined X* sufficiently / in enough depth *due to …*

The reasons for this result are not yet wholly / completely / entirely *understood.*

It cannot be ruled out / ignored *that there was some unintended bias in …*

An unintended bias cannot be ruled out / should be taken into consideration.

We cannot rule out that X might / may have influenced Y.

The observed increase in X *could* be attributed to / might be explained by it / could be interpreted as *being a result of …*

Despite the fact that / Although *X was expected to do Y, it was not predicted that X would also do Z. However, this is not particularly surprising* given the fact / in light of the fact / if we consider *that …*

43. Minimizing undesired or unexpected results

Although performance was not ideal / perfect / optimal, *we* still / nevertheless *believe that …*

This poor performance was not unexpected / surprising / very significant. *In fact …*

This result was not *expected / predicted / anticipated*. However, *the reason for this is probably / it is likely that the reason for this is / it is probable that the reason for this is* that …

Our investigations so far have only been on a small scale / applied to …

These discrepancies are negligible / can be neglected / considered as insignificant / are of no real consequence *due to the fact that …*

Despite the limitations of this method, and consequently the poor results in Test 2, our findings do nevertheless / in any case / however *suggest that …*

Given that / Since / On account of the fact that *this was only a preliminary attempt to do X it is hardly surprising that …*

As is well known, Xs are extremely hard / difficult / problematic / time-consuming / cumbersome *to control,* so / thus / consequently ….

In fact, X was beyond the scope of this study / not a primary goal in this research / not the focus of this study / not attempted in this study.

Consequently, it is inevitable / understandable / not hard to appreciate / not surprising that …

Note / It should be noted / It is worthwhile noting *that …*

A / One *limitation of our research is that the surveys were not conducted in the same period*. However / Nevertheless / Despite this, *we can still state that …*

We failed / were not able / were unable *to find a link between x and y, but this* may / might *depend on the methodology chosen for our research.*

44. Expressing opinions and probabilities

To the best of our knowledge / As far as we know / We believe that *no other authors have found that x = y.*

It would seem / appear *that …*

Our findings would seem to show / demonstrate / suggest / imply *that x = y.*

This factor may be responsible / is probably responsible / could well be responsible *for this result.*

Presumably / We hypothesize / I argue *that this factor is …*

We believe that our method could be used / probably be usefully employed *in*…

Our approach *would lend itself well for use by / may be useful for* …

In our opinion / view, *this method could be used in* …

We believe / feel strongly *that* …

There is evidence to suggest / support *the hypothesis that* …

It is proposed / This may mean / It seems likely / It may be assumed *that* …

This implies / suggests / would appear to indicate *that* …

The results point to the likelihood / probability *that* …

There is a strong / definite / clear / good *probability that* …

45. Announcing your conclusions and summarizing content

In conclusion / In summary / In sum / To sum up, *our work* …

Our work has led us to conclude / the conclusion *that* …

We have *presented / outlined / described* …

In this *paper / study / review* we have …

This paper has *investigated / explained / given an account of* …

46. Restating the results (Conclusions section)

The evidence from this study suggests / implies / points towards the idea / intimates *that* …

The results / findings *of this study* indicate / support the idea / suggest *that* …

In general, / Taken together, *these results* suggest / would seem to suggest *that* …

An implication / A consequence / The upshot *of this is the possibility that* …

47. Highlighting achievements (Conclusions section)

Our research / This paper *has* highlighted / stressed / underlined *the importance of* …

We have managed to do / succeeded in doing / been able to do / found a way to do *X.*

We have found an innovative / a new / a novel / a cutting-edge *solution for* …

We have obtained accurate / satisfactory / comprehensive *results* proving / demonstrating / showing *that* …

We have devised a methodology / procedure / strategy *which* …

We have confirmed / provided further evidence / demonstrated *that* …

Considerable progress has been made / insight has been gained *with regard to* …

Taken together, these findings suggest / implicate / highlight *a role for X*

Our study provides the framework / a springboard / the backbone / the basis / a blueprint / an agenda / a stimulus / encouragement *for a new way to do X.*

The strength / strong point / value / impact / benefit / usefulness / significance / importance *of our* work / study / contribution *lies in* …

X provides a powerful tool / methodology *for* …

X ensures / guarantees *that X will do Y, and it can be generalized to* …

Our investigations into this area are still ongoing / in progress *and seem likely to confirm our hypothesis.*

These findings add to a growing body of literature on / substantially to our understanding of *X.*

48. Highlighting limitations (Conclusions section)

Our work clearly has some limitations. Nevertheless / Despite this *we believe our work could be* the basis / a framework / a starting point / a springboard for

Despite the fact that there are / In spite of the fact that / Although *there are limitations due to Y, we …*

The most important limitation lies in / is due to / is a result of *the fact that …*

The current study was limited by / unable to / not specifically designed to…

The present study has only investigated / examined *X*. Therefore / Consequently …

The project / analysis / testing / sampling *was limited in several ways. First, …*

Finally, a number of potential limitations / weaknesses / shortfalls / shortcomings / weak points *need to be considered. First, …*

However, given the small sample size, caution must be exercised / taken / used / applied.

The findings might not be *transferable to / generalized to / representative of …*

The picture / situation *is thus still incomplete*.

49. Outlining possible applications and implications of your work

This study is the first step / has gone some way *towards enhancing our understanding of …*

These observations have several / three main / many implications *for research into …*

This work has revealed / shown / highlighted / demonstrated / proved *that …*

The present findings might help to solve / have important implications for solving / suggest several courses of action in order to solve *this problem*.

X is suitable for / has the potential to …

Our method / technique / approach / procedure *could be applied to …*

One possible / potential / promising *application of our technique would be …*

Results so far have been very promising / encouraging *and …*

This approach has the potential / requirements / characteristics / features *to …*

This could eventually / conceivably / potentially / hypothetically *lead to …*

Our data suggest that X could be used / exploited / taken advantage of / made use of *in order to …*

In our view these results are / constitute / represent *an excellent initial step toward …*

We believe / are confident *that our results may improve knowledge about …*

These early successes may hope to resolve / tackle / solve / deal with …

Another / An additional / A further important *implication is …*

Our research could help / be a useful aid for / possibly support *decision makers because …*

We think that our findings could / might *be useful for …*

We hope that our research will be helpful / useful / beneficial / constructive / valuable *in solving the difficulty of …* At the same time / In addition / Further / Furthermore *we believe that …*

Our research suggests that the policy makers should encourage / it is important for policy makers to encourage *stakeholders to …*

The findings of my research have serious / considerable / important *managerial implications*.

50. Future work already underway or planned by the authors

We are currently / now / in the process *of investigating …*

Research into solving this problem is already underway / in progress.

To further our research we plan / are planning / intend *to …*

Future work will concentrate on / focus on / explore / investigate / look into …

Further studies, which take X into account, will need to be undertaken / performed.

We hope that further tests will prove our theory / confirm our findings.

These topics are reserved for / deferred to *future work*.

51. Future work proposed for third parties to carry out

Further work needs to be done / carried out / performed *to establish whether …*

Further experimental investigations / tests / studies *are needed to estimate …*

More / Additional / Further *work on X, would help us to do Y*.

We hope / believe / are confident *that our research will serve as a base for future studies on …*

It is recommended / We recommend / We suggest / We propose *that further research should be undertaken in the following areas:*

More broadly / On a wider level, *research is also needed to determine ….*

This research has raised / given rise to / thrown up *many questions in need of further* investigation / study / examination.

This is an important / a fundamental / a vital issue *for future research*.

The design and development of Xs will challenge / be a challenge for *us for years*.

Future work should concentrate / focus *on enhancing the quality of X*.

Future studies should target / aim at / examine / deal with / address *X*.

Future studies on the current topic are therefore required / needed / recommended / suggested *in order to* establish / verify / validate / elucidate …

Our results are encouraging / promising *and should be validated by a larger sample size*.

These findings suggest the following directions / opportunities *for future research: ….*

An important issue / matter / question / problem *to resolve for future studies is …*

The prospect of being able to do X, serves as a continuous incentive for / stimulus for / impulse for / spur *to future research*.

52. Acknowledgements

This work was carried out / performed *within the framework of an EU project and was partly sponsored by …*

This research was made possible by / benefited from *a grant from …*

Support was given by the Institute of X, who funded the work in all its / its initial *stages*.

We thank / would like to thank *the following people for their support, without whose help this work would never have been possible:*

We gratefully acknowledge the help provided by Dr. X / constructive comments of the anonymous referees.

We are indebted / particularly grateful *to Dr. Alvarez for …*

We thank / are grateful to / gratefully acknowledge *Dr. Y for her* help / valuable suggestions and discussions.

Thanks are also due to / The authors wish to thank *Prof. X, who gave us much valuable advice in the early stages of this work.*

Dr. Y collaborated with / worked alongside *our staff during this research project.*

We also thank Prof. Lim for her ongoing collaboration with our department / technical assistance in all our experimental work.

53. Referring to tables and figures, and to their implications

Table 1 compares / lists / details / summarizes *the data on X.*

Table 2 proves / shows / demonstrates / illustrates / highlights *that X is …*

Figure 1 presents / reports / shows / details *the data on X*.

Figure 3 pinpoints / indicates *exactly where X meets Y*.

As shown / highlighted / illustrated / detailed / can be seen *in Fig. 1, the value of …*

The value of X is greater when Y = 2 (Fig. 1 / Eq. 2)

The results on X can be seen / are compared / are presented *in Fig. 1*.

From the graph / photo / chart / histogram *we can* see / note *that …*

It can be seen in / is apparent from *Fig. 1 that …*

We observe / note *from Table 1 that ..*

The graph above / below / to the left / to the right *shows that …*

Figure 8 shows a clear trend / significant difference *in …*

The table is revealing / interesting *in several ways. First …*

54. Making transitions, focusing on a new topic

If we now turn to / Turning now to / Let us know look *at the second part …*

As far as *X is / Xs* are concerned …

As regards / Regarding / Regarding the use of / As for *X, it was found that …*

55. Referring backwards and forwards in the paper

As was mentioned / stated / noted / discussed / reported *in the Methods, …*

As reported above / previously / earlier / before …

As mentioned / stated / outlined *in the literature review …*

The above- / afore-mentioned *X is …*

More details on this will be given below / in the next section / in the appendix.

The following is / Here follows / Below is *a list of …*

Please refer to Appendix 2 / Table 6 / the Supplementary Material *for….*

56. Referring back to your research aim

As stated in the Introduction, our main aim / objective / target / purpose / goal *was to …*

As stated in the Introduction, the research was conducted / undertaken / carried out *in order to …*

Given that / Since *our main aim was, as mentioned in the Introduction, to …*

Before interpreting our results, we remind the reader of / would just like to restate *our main aims*.

Returning to the hypothesis / question *posed at the beginning of this study, it is now possible to state that …*

57. Referring outside the paper

See the respective handbook [Ref] for a description of X.

For a detailed review on this topic see [Ref].

More details on this topic can be found in [Ref].

Chapter 20
The Final Check

Why is this chapter important?

Many researchers finish their manuscripts just before (and often after!) the deadline. Due to such pressures of time, they often send their manuscript to the editor without doing a final check. Most manuscripts are written by multiple authors. This involves a lot of exchanges of versions of the manuscripts, with a consequent increase in the possibility of mistakes being introduced. Lots of changes are made at the last minute, and often no one checks them for accuracy in terms of English. One author needs to be responsible for the final check.

This chapter covers the kinds of things you should look for when doing this final check. The result is that you will increase the chances of your paper being accepted.

Referees are famous for asking for revisions before acceptance, which often involve what you might consider as trivial details, such as typos and spelling mistakes. Such delays cost you time and money and may also mean that another paper on the same topic gets published before yours.

A. Wallwork, *English for Writing Research Papers*,
DOI 10.1007/978-1-4419-7922-3_20, © Springer Science+Business Media, LLC 2011

What the experts say

The maxim "Good Writing is Re-Writing" is fundamental to producing a well written paper. Having a good first draft is the starting point for really crafting the logic, structure, and flow of your writing. Rewriting can also be the most fun, intellectually engaging, and satisfying part of the writing process.

Professor Ken Lertzman, School of Resource & Environmental Management,
Simon Fraser University, Vancouver, Canada

It's always a good idea to get someone else read through what you have written (for typos, clarity of expression etc.). In my experience, editing other people's work in an objective way is far easier than editing your own stuff!

Mark Worden, editor Speak Up, and author

Having your manuscript revised by a professional editing service prior to journal submission will greatly improve the quality of its English – both the grammar and also the readability. Additionally, if the editor has experience as a researcher and is familiar with your discipline, then minor technical errors can also be corrected at this stage. Overall, your work will then create a much better impression with the journal referees, thus reducing the number of their criticisms and misunderstandings, and increasing the chances of its acceptance for publication.

Alexander (Sandy) Lang, founder / director of Rescript,
a professional editing service

20.1 Ensure your paper is as good as it could possibly be the first time you submit it

On the excellent pages on the website of the University of Canberra (see link on page 313 (16.8)), Professor Ken Lertzman makes the following comment:

> It takes much longer to read poor writing than good writing. It is a waste of an advisor's or editor's time to read material that is not yet ready to be presented - and it is disrespectful to expect them to do so.

Researchers tend to leave the manuscript writing process to the very last minute. This often results in a poorly written paper. Unfortunately, poor English and lack of clarity are one of the most frequent causes of a paper being initially rejected. You will waste several months if you have to resubmit your paper, and in the meantime someone else might publish a paper on the exact same topic!

Ideally, you should get a colleague to read through you manuscript to check for points 20.7–20.19 below.

20.2 Print out your paper. Don't just correct it directly on your computer

It is good practice to print out your paper. You are more likely to find mistakes connected with grammar, word order, and structure. Convert your document into a font that you find easy to read (e.g. Arial) and use 'double space' line spacing.

On screen you have much less perception of how your paper will look visually, and may not even notice that a paragraph is more than a page long. In a printed version, such long paragraphs are instantly visible. You thus have the opportunity to break them up into shorter paragraphs that are easier on the eye. Breaking up paragraphs is quick and easy to do (Sect. 4.13).

Also, ask a colleague to read your printed version. He or she will very likely find mistakes that you have overlooked - in fact, your familiarity with your own work makes it quite difficult to spot errors.

Finally, read your manuscript aloud. You will find mistakes that are hard to find by reading silently – particularly with regard to how a sentence flows and whether there are words missing.

20.3 Always have the referee in mind

The key factor when revising your paper is to have the referee in mind. Here are two quite typical comments related to poor writing skills.

> I often had to defer my interpretation of the meaning of a sentence until I had read it in its entirety. Frequently I got lost in a series of subordinate clauses. The paper would thus benefit from a major revision from a language point of view.
>
> This paper could be improved considerably if the authors gave more consideration to their readers. At times it was difficult to follow the logical connection of the authors' ideas, and on several occasions I was tempted to stop reading completely.

Referees often make a direct connection between the time and effort that an author makes in presenting information, and how much time and effort the author has spent in doing their research. If the information is presented badly, then the implication is that the research may have been conducted badly too. Also it helps to remember that referees make reports on manuscripts in their free time for no financial reward – they are of much more benefit to you, than you are to them!

20.4 Anticipate referees' comments on your English

Dr Robert Coates, author of the paper 'Language and publication in Cardiovascular Research articles', has found that "badly written articles" correlate with "a high rejection rate".

> Many factors could influence the rejection of an article. However, we found clear indications that carelessly written articles could often have either a direct or subliminal influence on whether a paper was accepted or rejected. On equal scientific merit, a badly written article will have less chance of being accepted. This is even if the editor involved in rejecting a paper does not necessarily identify language problems as a motive for rejection.

His research refers to papers that were submitted for publication in Cardiovascular Research – see page 314 for a link to his very revealing article. He also found that manuscripts that had the lowest acceptance rate also had the highest error rate in terms of English.

This does not mean that all papers with high error rates were rejected, or that low acceptance rate was determined exclusively by poor English. But he did find a definite correlation.

Referees are generally not English language experts. They are interested much more in the scientific content than in the level of English. The comments that referees make on your English often depend on whether they are native speakers (NS) or non-native speakers (NNS).

NNS referees tend to recognize the elements of 'poor' English that for them stand out the clearest:

- spelling mistakes and typos
- simple grammar mistakes (e.g. missing *s* on plurals and third person)

Here is a typical example, written by an NNS referee commenting on an NNS's English:

> A big problem with this work is the English form: there are so many language errors that it actually seriously compromises one's ability to understand what is being presented. The paper needs an extensive revision by a native English speaker.

NS referees, on the other hand, tend to focus more on problems related to intelligibility and readability: verbosity, redundancy and rambling sentences. Many native English-speaking referees are sympathetic to their non-native colleagues. One reviewer I contacted said:

> I typically don't comment on minor grammatical issues in my reviews unless the grammar makes the content hard to follow or understand. I can't imagine having to write all my scientific papers in a second language—it's hard enough to do in a native language—so I have a lot of sympathy for people who have that obstacle to publication.

Grammatical and lexical errors are unlikely to completely impair a referee's understanding of your paper, but too many of them might cause referees to become irritated and to lose interest not only in what you are writing about, but in you as well. Basically if your paper is filled with errors this requires too much effort on the part of the referee and this may have a negative impact on his / her opinion not only of your paper but also on your credibility as a reliable researcher.

All referees object to spelling mistakes, particularly as this is something that authors can easily check themselves. A series of trivial and easily correctable mistakes, may make some referees feel that you are not very competent and reliable - and their opinion of your English may even throw doubts on their opinion of how well you carried out your research.

Judging errors is an extremely subjective exercise, and different referees may have very different ideas about what they would term as 'intolerable' or 'objectionable' errors. This may help to explain those occasions when your paper is rejected by one referee for 'very poor' English, whereas the other referees make no comment at all about the English level.

Sometimes referees will give no specific reasons for rejecting your paper due its poor English, but they will say something like: This referee recommends that the authors have their paper revised by a qualified native English speaker. This may happen for two reasons:

1. the referee is either a NS or a NNS and feels that the quality of the English is low but is unable to pinpoint exactly what it is. In this case, the cause of the problem is generally an overall lack of readability.
2. the referee is a NNS, is not sure of the level of English, and wants to protect himself / herself just in case there are errors. This is a face-saving device adopted by NNS referees in relation to the editor. However, please note that this only happens in some cases, and is not a general rule.

With regard to the second point, I once revised a paper for a client and I highlighted three terms that were unfamiliar to me and which I recommended the author should change. For some reason the author did not make these particular changes and his manuscript was initially rejected. Of course the rejection was primarily for scientific reasons and not problems with the English (I had, after all, revised the English and apart from the words and phrases I had highlighted, the English was perfect). However, all three referees spotted the unfamiliar terms which included one word that was archaic (i.e. a word that is no longer used) and two terms that the author had clearly invented himself. Purely on the basis of these three vocabulary items, two of the referees recommended that the paper be revised by a professional mother tongue editor before being accepted for publication - despite the fact that the paper was actually in near perfect English.

How is this possible? The two referees were in fact both NNSs - I could recognize this from the English of their reports which contained some errors. What they saw was three clear errors of English. Their feeling was probably "If I have recognized these three errors, there may be many others too that I may not be able to spot. To protect myself, and the author, I think I should recommend a revision by a professional".

Having to submit your manuscript to a professional not only has a monetary cost, but also causes further delay to your paper being published. Consequently:

1. it is generally wise to take into account the comments made by professional proofreaders - if you don't agree with your proofreader's recommendations, then contact him/her again for clarifications
2. you should make sure that the words you use are in current use. The fact that your spell checker does not underline it in red, or that you found the word in a reputable dictionary, does not mean that is acceptable to use
3. you should never invent terms, even if the term you invent is made up of words that actually exist and are commonly used. For example, although you can say 'bankruptcy law', 'employment law' and 'immigration law', you cannot by analogy (i.e. noun + *law*) invent the term 'nature law' or 'population initiative law' even though similar terms may exist in your own language

You can easily check for points 2 and 3 by searching on Google Scholar and ensuring that the returns are from native speakers.

20.5 Judge your writing in English in the same way as you would judge it if you had written the paper in your native language

What you write has to make sense. In my job as an editor and proofreader of research papers, I read a lot of sentences, sometimes even whole paragraphs, that appear to make no sense. The problem is particularly acute in the more humanistic

sciences, where the author is expressing ideas and theories, rather than drawing conclusions from hard data.

For me the reason why such sentences make no sense is due to one or more of the following:

1. The author is not really interested in conveying his (for the sake of simplicity, I will imagine that the author in question is a man) meaning to the readers.
2. The sentence would have made little or no sense even in the original language. The author hoped that in some miraculous way it would make more sense in English.
3. The author had an idea in his head. This idea appeared to make sense in his own language. He translated it into English. He looked at the result, which appeared to him to match what he was trying to say. In addition, it sounded good in English. But he did not have the critical faculties to decide whether the sentence, in its English version, really did make sense. It is as if English filters out the author's good judgment. It seems to allow the author to distance himself from what he writes. In fact, reading a sentence that you have written in your own language is a different experience from reading a sentence that you have written in a foreign language. When you are writing in your own language you are perhaps more critical of yourself and you are much more aware of how your peers will perceive what you have written.

20.6 Cut, cut, cut and keep cutting

Imagine that you have been asked by the referee to reduce your paper by 25%. As you go through the paper, cut as much as you can (without necessarily eliminating any content). This very rarely leads to a poorer manuscript, more often it improves it massively. On the basis of identical content, there is no referee in the world who would prefer to review a paper of twenty pages rather than fifteen.

Make sure you haven't included any sentences or paragraphs just because they sound good to you or you are particularly pleased with the way you have expressed yourself. For example, in this chapter I could have removed the subsection above (Sect. 20.5), but I decided to include it as an example of something that could be cut!

I could also have cut the quotation below by Joseph Addison (1672–1719), English essayist, poet and politician:

> The English delight in silence more than any other European nation, if the remarks which are made on us by foreigners are true. ... To favour our natural taciturnity, when we are obliged to utter our thoughts, we do it in the shortest way we are able.

Being an Englishman myself I love this quotation, though I am not sure how relevant it is for the purposes of this book!

Finally, a few months into the future you will not even remember what you cut. It may seem desperately important for you to include something now, but really ask yourself: Do my readers need to read this? Will they notice if I have cut it out?

20.7 Check your paper for readability

Website designers follow the principle of 'don't make me think'. This means that everything should be so clear to visitors to their websites, that these visitors intuitively know where to find the information they need. The visitors are not required to think.

Similarly, writers of technical manuals focus on presenting information in an orderly straightforward fashion that requires minimal intellectual effort on the part of the reader – they want the readers to assimilate the information in a relaxed way, they don't want to make their readers tired and stressed.

Richard Wydick, Professor of Law at the University of California, writes:

> We lawyers do not write plain English. We use eight words to say what could be said in two. We use arcane phrases to express commonplace ideas. Seeking to be precise, we become redundant. Seeking to be cautious, we become verbose. Our sentences twist on, phrase within clause within clause, glazing the eyes and numbing the minds of our readers. The result is a writing style that has, according to one critic, four outstanding characteristics. It is "(1) wordy, (2) unclear, (3) pompous, and (4) dull."

You do not want referees and readers to consider your work wordy, unclear, pompous, or dull, so when you make the final check of you manuscript, ask yourself the following questions:

- are my sentences reasonably short? (sentences longer than 30 words are generally hard to assimilate without having to be read twice)
- are my paragraphs reasonably short?
- have I only written what adds value, have I ensured there is no redundancy?
- have I clearly differentiated my work from the work of others so that the referees can understand what I did in relation to what others have done before me?
- have I highlighted my contribution and the gap it fills so that the referees can judge whether my paper is suitable for my chosen journal?

Readability is also affected by the following factors (these are all covered in Part 1 of this book):

- poor layout: large blocks of text are hard to read, whereas short paragraphs with white space in between them are much easier
- ambiguity and lack of clarity: the reader is not sure how to interpret a phrase
- lack of structure: within a sentence, paragraph or section
- too much abstraction: the reader is not given concrete explanations or examples
- lack of consistency

20.8 Check for clarity in the logical order of your argumentation

In English it is considered good practice to state upfront what will be argued in an article and how. As you re-read your manuscript make sure there is a logical progression of your argument. Don't be influenced by how a paper might be written in your own language. Kateryna Pishchikova, a Doctor of Philosophy in Linguistics, says:

> Russians tend to use long and complicated sentences. They often follow a "detective story" logic according to which the reader has to follow the events or arguments as they unfold and will only learn what the author is trying to say at the end. Overall, complexity, and not clarity, is synonymous with good scientific or specialist writing.

So check that your key findings are not hidden in the middle of sentences or paragraphs.

20.9 Do a 'quality control' on your paper

According to David Dunning, author of the paper on incompetence (Sect. 12.9):

> A full 94% of college professors state that they do 'above average' work, although it is statistically impossible for virtually everybody to be above average.

You too may consider your paper to be above average work, but it is worth checking the coverage (i.e. what referees expect to find) and quality of each section by referring to the final subsection in each of Chaps. 11–18.

If you have time it is a good idea is to get colleagues to review your manuscript (including the title), and you review their work. Often it is much easier to spot mistakes (grammatical, stylistic, structural etc.) in other people's work than in your own. But you can improve your critical skills of your own work if you become accustomed to critically evaluating other people's papers.

20.10 Be careful with cut and pastes

If you write your paper in conjunction with other authors you multiply the chances of mistakes and ambiguity. Words such as *it, that, this, one, former, latter* and *which* are potentially dangerous if the words they refer to are subsequently changed by another author. For example, imagine Author 1 writes

> ... Russia, Canada and the United States. In the former ...

Then, in order to put the countries in alphabetical order, Author 2 modifies it as follows:

... Canada, Russia and the United States. In the former ...

The problem is that *the former* in Author 1's sentence refers to Russia. But in Author 2's sentence *the former* refers to Canada. To avoid such mistakes it is always best to repeat the key word rather than using *it, that, this, one, former, latter* and *which.* In any case, if it is your job to read the final version of the manuscript it is worth taking such problems into consideration.

For more on sources of ambiguity see Chap. 6.

20.11 Double check that you have followed the journal's style guide

It is highly irritating for referees and editors when authors submit papers that do not respect the stylistic requirements of the journal. This is particularly true with regard to how you cite the literature both within the body of the paper and in the Literature Cited section.

20.12 Make sure that everything is completely accurate

This avoids referees from having to include in their report lists of small things that need changing. A paper for publication in a journal is very different from a thesis. When you wrote your thesis, you may not have been too worried about being completely accurate in the way you presented references and you may not have proofread it very carefully – "in any case" you thought "no one is ever going to read it". But people will read your manuscript, starting with the referees. If they find that you have cited papers in your introduction but not put them in the bibliography, or vice versa, or if they see spelling mistakes, they might think to themselves: this author has paid little attention to the form of the paper, so there is a strong probability that their research suffers from the same level of unreliability.

20.13 Make sure everything is consistent

Referees will suggest a delay in the publication if they find inconsistency in your paper. Here is a genuine example from a referee's report. The only thing I have changed is the key words (X and Y).

- "Figure 1" on page 4, yet "fig 5a" on page 8.
- page 4: "Figure 1 shows an example of an X graph," yet page 5: Figure 1 caption states "Example of Y". So is it a Y or an X graph?
- commas after some equations like on page 10, but not on all equations.
- caption to Fig 4 states "Initial Size Distribution," yet the illustration is of a graph not a size function.
- sometimes comma after i.e. e.g., and other times not

Here are some extracts from another referee's report, which again highlight the importance of what you may consider to be fairly marginal issues:

> This work is novel and is worthy of publication. However, the presentation of the work is, quite frankly, unprofessional. There are many sloppy mistakes like spelling mistakes and incorrect references, as well as inconsistency such as changing terminology and differences between captions and inline text. Before being accepted for publication the authors need to pay careful attention to the points listed below.

20.14 Dealing with rejections

Most journals reject large numbers of papers. In general, the higher the impact factor of a journal, the higher the risk of rejection. Don't be put off. The highest ranked journals also tend to have the fastest turnaround and may thus return your rejected paper quite quickly. The benefit to you is that you are likely to be given a peer review of an excellent standard, which should help you to revise your paper before submitting it elsewhere. See rejection as an opportunity for making your paper even better.

To give you an idea of how difficult it is to publish a paper in a top ranking journal, here are some statistics from the 'Welcome to resources for authors' page of the website of the British Medical Journal (BMJ), one of the world's most prestigious journals.

> We can publish only about 7% of the 7,000–8,000 articles we receive each year.
> We reject about two thirds of all submissions without sending them for external review.

However there are still advantages of sending your paper to such a journal, even if there is a very high chance of rejection. The BMJ makes very quick decisions (2–3 weeks) so you don't really delay your chances of publishing elsewhere. If they don't even send your paper for external review, it either means your paper is outside the scope of the journal, or that it has some serious flaws in terms of science and/or structure and language. This is a clear indicator that you need to seriously revise your paper. If the BMJ does decide to submit your paper to peer review, the reports you will receive from the reviewers will be very helpful in indicating how your paper can be improved.

20.15 Take editorial comments seriously

There is a tendency to only take into account referees' comments that you agree with and to discount everything else. However, if a referee says that he/she cannot understand what you mean, there is a very good chance that readers will have the same problem.

20.16 Consider using a professional editing service

Consider having your paper corrected through a professional agency or native speaking peer (i.e. someone in the same field as you who has also had papers published). Having your paper revised is certainly a cost, but the cost involved is likely to be far less than 1% of the cost of actually carrying out the research. Yet a good revision will massively increase the chances of your paper being published.

It is wise not to entrust your paper simply into the hands of a local English teacher or the English-speaking husband/wife of a colleague. The fact of speaking or even teaching a language rarely qualifies a person to carry out the difficult task of proof-reading and editing a scientific text.

Some agencies will also give you advice on how to improve your paper in general, and thus act as a pre-refereeing service.

20.17 Don't forget the Acknowledgements

The Acknowledgements generally include one or more of the following.

- Sources of funds.
- People who gave significant technical help (e.g. in the design of your experiment, in providing materials).
- People who gave ideas, suggestions, interpretations etc.
- The anonymous reviewers

It is a good idea to let the people that you wish to acknowledge see the exact wording of how you want to acknowledge them - they might think it is too effusive (or occasionally, insufficient).

The style of giving acknowledgements may be quite different from the style of the rest of the paper. For example, you can use the first person (*I, we*).

Keep your acknowledgements as short as possible, they are generally of little interest to anyone apart from those mentioned.

20.18 Write a good letter / email to accompany your manuscript

If your English is poor in your email, the editor may suspect that the English will be poor in the manuscript too. This is not a good start. To learn how to write effective emails, see the companion volume: English for Academic Correspondence and Socializing.

20.19 Final check: spelling. Don't underestimate the importance of spelling mistakes

I cannot overestimate the importance of doing a final spell check as the very last thing you do before submitting your manuscript.

Poor spelling is considered to be a huge embarrassment in the English-speaking world. Children spend many years learning correct spelling, and adults have been humiliated because of incorrect spelling (remember US Vice President Dan Quayle?). Consequently, rightly or wrongly spelling is a major issue in international journals.

Referees have been known to initially reject a manuscript on the basis of incorrect spelling alone (though I suspect that sometimes this is for political reasons!).

In any case, referees do not like to see spelling mistakes, and some may think that there is an implicit relation between not taking time to check your spelling and possibly not checking your data! Make sure you choose the correct version of English - US or UK - corresponding to your chosen journal. Their style guide for authors should in any case tell you which spelling system they require.

Spelling checkers only pick up words that are not contained in their dictionaries. Mistakes and typos like the ones below would not normally be found because they are words that are in the dictionary (though not with the meaning that the author intended).

The company was *funded* in 2010. (founded)

The samples were *weighted* and *founded* to be 100 g. (weighed, found)

It was different *form* what was expected. (from)

Be careful of: *choose / chose / choice, filed / field / filled, then / than, through / trough, use / sue, with / whit.*

There is a tendency to ignore Word's (and other software's) red underlining of technical words. Just because such words are not in the software's dictionary, does not necessarily mean that you have spelt them correctly.

Spell checkers may not be perfect, but they are very useful. Grammar checkers are also likely to find a few mistakes that you may not have noticed. They will help you find errors connected with subject verb agreement, word order, punctuation (before *which* and *and*, and with hyphenation between words), unnecessary passive forms etc. Obviously the grammar check can only make suggestions, but Word's grammar check found several mistakes in the draft of this book.

20.20 Summary

- Respect the referee. Don't waste his or her time by submitting a poorly written manuscript
- Get a colleague to read through your paper or use a professional editing service
- Print a hard copy of your manuscript. Don't rely on reading it on screen
- Check for all types of mistakes in English: grammar, vocabulary and spelling
- Apply the same standards as if you had written your manuscript in your own mother tongue
- Cut as much as you can
- Check your manuscript for readability and logic
- Be careful with problems cause by multiple authors, e.g. cut and pastes
- Ensure you have followed the journal's style guide, e.g. for citing the literature
- Check for accuracy and consistency
- Take editorial comments seriously
- Remember to acknowledge those that helped you
- As your last task before sending the manuscript to the journal, do a spell check. Don't rely 100% on automatic spell checkers. Spell checkers do not know the difference between *witch* and *which,* or *weighed* and *weighted*