

Maastricht University

Maastricht Science College

A Guide to Scientific Writing Skills

Robert Wilkinson

©2013 Robert Wilkinson, Maastricht University.

All rights reserved. No part of this book may be reproduced or utilized in any form or by means, electronic or mechanical, including photocopying, recording or by any information storage and retrieval system, without prior permission from the copyright owner, or, as the cases may be, the publishers, beyond the exceptions provided for in the Copyright Law.

There is something I don't know
 that I am supposed to know.
I don't know *what* it is I am supposed to know,
 and yet I am supposed to know,
and I feel I look stupid
 if I seem both not to know it
 and not to know *what* it is I don't know.
Therefore I pretend I know it.

R.D. Laing (1970). *Knots* (p.56). London:
Taylor & Francis

Table of contents

Preface	2
1. Introduction	4
2. The planning process	11
2.1. The planning activities	11
2.2. The planning outline	12
3. Structuring	17
3.1. The introduction	17
3.1.1. The background information	18
3.1.2. The purpose statement	19
3.1.3. The short outline in the introduction	22
3.1.4. The organization of paragraphs in the introduction	23
3.2. The middle sections of your paper	25
3.3. The discussion and conclusions	27
3.4. The organization of a paragraph	29
3.4.1. The topic sentence	29
3.4.2. The elaboration and closure	30
4. Citation of sources	37
4.1. The importance of citation	38
4.2. Systems for citing and referencing	40
4.3. How to cite information from other sources	41
4.3.1. Paraphrasing and generalizing	41
4.3.2. Direct quotes	42
4.3.3. Placing the citation in the sentence or in parentheses	43
4.4. In-text citations	46
4.4.1. One source by multiple authors	47
4.4.2. One source with no author	48
4.4.3. One source with no date	48
4.4.4. Two or more sources	49
4.4.5. Personal communications and entire websites	50
4.5. The list of references	52
4.5.1. General principles governing elements of reference entries	54
4.5.2. Examples of references	58
5. Manuscript presentation	62
5.1. Format requirements	62
5.1.1. The title page	63
5.1.2. The title	63
5.1.3. Table of contents	64
5.1.4. Sections of a paper	65
5.1.5. General format requirements	65
5.2. Footnotes	68
5.3. Tables and figures	69
5.3.1. Tables, figures, and other exhibits from another source	69
5.4. Revising the paper	71
5.4.1. Revising the content	71
5.4.2. Revising the style and tone	72
5.4.3. Revising the grammar, spelling, and punctuation	73
5.5. Evaluation	75
References	76
List of Tables and Figures	77

Preface

This guide is written with the aim of helping you become proficient writers in the sciences during your studies at Maastricht Science College. As you progress through your studies, writing experimental reports, literature reviews, case studies, research papers, theoretical papers, opinion papers, and more, you will gradually demonstrate your growing expertise as a writer in your chosen discipline. Your writer serves as a marker not only of your relative expertise, but also of how socialized you are in the discipline.

Writing too serves as a means. The act of writing helps you organize and synthesize your thoughts. It helps you recognize strengths and weaknesses in ideas and arguments. This guide thus takes you through the writing process, from the initial idea, through the development of a draft, to the final revision.

A large part of this guide is devoted to technical matters, of which the most prominent are citing and referencing practices. Chapter 4 of this guide is explicitly concerned with such matters. However, bear in mind that there are many different systems that are used in the sciences for citing and referencing. This guide, though, focuses only on one of them, the APA style. While you are required to follow this style for the training phases of your study, it is always possible that you may be required at later stages to follow a different system.

Much success with your scientific writing.

Robert Wilkinson

Maastricht University Language Centre

NOTE: the Guide is not presented in the format that you have to present your papers (see section 5).

Acknowledgements

This guide is based on an earlier one written for the School of Business and Economics (Mennens & Wilkinson, 2002; Wilkinson & Hommes, 2010). Grateful acknowledgements are due to the many people

and sources consulted during the construction of this guide, in particular, to Roy Erkens, Ariane Perez-Gavrilan, and John Sloggett of Maastricht Science College, Henri Mennens, Keith Campbell, and Jeannette Hommes, as well as to the Academic Writing tutors of the Language Centre and the many students who have used the earlier works; to Mike Hannay and Lachlan Mackenzie, whose book *Effective writing in English: A resource guide* (both the 1996 and 2002 editions) has been a major source of information for chapters 2 and 3; to the American Psychological Association whose “*Publication manual*” (American Psychological Association, 6th ed., 2010) has been an excellent support in the construction of chapter 4 in this guide; and finally, to the Dean of Maastricht Science College for supporting the production of this volume.

1. Introduction

When we think of science writing, we can think of many different types of writing. For example, there is science writing in newspapers.

We're fortunate that the amount of solar radiation reaching the Earth's surface is very stable. Climate contrarians will often ask if we'd prefer if the planet were warming or cooling, suggesting that global warming is a good thing because at least the planet isn't getting colder. This is a false dichotomy - an ideal climate is a stable one.

The relatively stable climate over the past 10,000 years has allowed establishment of human civilization, by making it possible to create large stationary agricultural farms because we could rely on stable weather patterns. During that time, [net global surface temperatures changes haven't exceeded 1°C](#) from the coldest to the hottest climates, though we're now approaching that degree of change, with 1°C warming since the LIA, 0.8°C of that over the past century, with much more to come.

Source: Dana Nutellini (2013, August 14). A grand solar minimum would barely make a dent in human-caused global warming. *The Guardian*. Retrieved from www.theguardian.com

We notice features like the contractions (we're), expressions (we're now approaching), unsupported claims (climate contrarians will often ask), features that we associate with journalism. Similarly, there is popular science writing such as:

Why stick with just one member of the opposite sex when there are so many to choose from?

Love and tax breaks may be the reasons we cite today, but our primate ancestors had other motivations. Preventing a newborn from being killed by an unrelated male was top of the list.

Social [monogamy](#) – when a male and female of the species stick together for the long term, although may mate with others – is rare in mammals generally. However, it occurs in over a quarter of primate species, including [humans](#), gibbons and many New World monkeys, such as titis.

To investigate what originally drove us to establish such pair bonds, a team led by [Kit Opie](#) of University College London and [Susanne Shultz](#) from the University of Manchester, UK, gathered data on the mating behaviour of 230 primate species. They selected behavioural traits associated with several possible evolutionary drivers of monogamy, including the risk of infanticide, the need for paternal care and the potential for guarding female mates.

Source: Mairi Macleod (2013, July 30). Monogamy evolved to keep baby-killers away. *New Scientist*. Retrieved from www.newscientist.com

In this kind of science journalism, we can observe that the report mentions who has been conducting the research (Kit Opie and Susanne Shultz): the researchers themselves are not writing the report.

Somewhat similar is science writing in *Scientific American*:

And yet “chaotic” does not mean “random” or “unpredictable,” at least in principle. In the past decade or so mathematicians have created a theoretical framework for understanding the persistent structures such as transport barriers that are hidden in chaotic fluids. In 2001 George Haller, a mathematician now at the Swiss Federal Institute of Technology Zurich, gave these structures the rather unwieldy name “Lagrangian coherent structures.” More poetically, Haller calls the intricate structure of transport barriers “the skeleton of turbulence.” Once you have identified these structures in a body of fluid, you can make useful short- to medium-term predictions of where the fluid flow will carry an object, for instance, even without a perfect, precise solution of the Navier-Stokes equations

Source: Dana Mackenzie (2013, July). Walls of water. *Scientific American*. Retrieved from www.nature.com/scientificamerican/journal

All of the articles from which the extracts above have been taken are written for the general public, albeit an educated one, and they are written by journalists, albeit journalists with a background in science. They are in other words secondary sources. The journalists may give links or indicate the sources of the information they describe. They are not scientific articles written by scientists for other scientists. However well they are written, we do not consider them *academic* articles.

The following extract is the first paragraph of an academic article in the sciences. You will quickly notice that it differs considerably from the journalism texts illustrated above.

In recent years, lanthanide chemistry has attracted great interest for the various molecular structures with different applications.^{1, 2, 3} A lot of work has been done to direct synthesize super-molecular compounds due to their interesting topologies and potential applications as a functional materials.^{4, 5, 6, 7} The reasonable design of super-molecular structure depends on the concepts of non-covalent forces such as coordination and hydrogen bonds. Polyvinyl alcohol (PVA) anions are suitable bridging ligands for constructing network coordination polymers.^{5, 6, 8, 9, 10} PVA is a semi-crystalline polymer and its crystalline index depends on the synthetic process and physical aging.⁸ It has gained increasing attention in the biomedical field due to bioinertness.^{11, 12} Polymers and polymeric composites have steadily gained growing importance in our daily life. Doping of transition metal salts into permanently polarized vinyl polymers in a multiphase system can induce pronounced changes in various properties of complexes. These complexes can be used as sensors electro-chromic displays and solid state lasers.¹³

Source: Hanafy, T.A. (2012). Dielectric relaxation and alternating current conductivity of lanthanum, gadolinium, and erbium-polyvinyl alcohol doped films. *J Appl Phys.* 2012, 1, 112(3): 034102. doi: [10.1063/1.4739752](https://doi.org/10.1063/1.4739752)

Features that you will notice immediately are the way in which the author refers to the sources of previous research (in this case via numerical superscript), the nature of the previous research reported (what is known, what has been found in studies), and the density of field-specific terminology. Note that there are several different systems for reporting other research. While this Guide will mention a few of them, we will concentrate on only one – which is the system you are expected to follow during at least the early part of your studies.

During your studies, you will gradually become more aware of the field-specific nature of academic writing: this is the kind of writing you are expected to produce. Moreover, the academic journals, books, and research reports are the kind of sources you are expected to consult during your studies. You should not model your writing on the journalism examples above. Nor are you expected to use the journalism texts as sources for your own writing.

Scientific writing covers the wide range of specific writing tasks that you are required to write during the course of your academic studies: papers, experimental reports, literature reviews, projects, case studies, dissertations, theses, research papers, and articles. Some of these text types are quite rare outside the academic environment (papers, literature reviews, dissertations, theses); others (reports, projects, etc.) may well be aiming at a much broader scientific public. However, what they all have in common is a similar type of reader: a person educated in the specialist field (here the sciences in general), and usually acting as a professional in that field. These target readers represent the professional community of which you aim to become a member. To be accepted as member requires you to meet the norms and standards that the professional community expects. Thus with regard to writing, you are expected to adhere to the norms expected by the (international) scientific or academic community.

Compare this to a relay race in athletics. In the relay race, you run with three other runners. If you are one of the two middle runners, you have to collect the baton smoothly from the previous runner and pass it on to the next runner. In the relay race your team runs against other teams (your local community). All of you have to run according to the set of rules agreed by the sports governing body (the professional community). If you do not, your team may be disqualified. The rules set the framework for a potentially great race, and

within the rules there is vast scope for individual flair and talent. So with academic writing: you have to write according to the “rules”, but to write well demands your own individual talent and enterprise. Just as a highly skilled athlete knows how to use the rules to his advantage, so an expert writer uses the norms and standards of professional academic writing to persuade readers of the power of his argument.

We should not extend this athletics analogy too far: sports have clear sets of rules that everyone can read and study; academic writing does not. What a professional academic field has is a set of *overt norms*, such as a style guide. This guide is based on the editorial style requirements described in the sixth edition of the *Publication Manual of the American Psychological Association* (2010), although other styles that are common in some of the sciences are mentioned too (see the example on page 4 above). Alongside these is a set of *covert norms* that are just as powerful. An example of the covert norms will be the nature of argumentation that is considered acceptable in the field. Covert norms are hidden and therefore take a long time to acquire. Most novice writers acquire them through *extensive reading* in the field, and by paying active attention to the way other writers use language. This process of acquisition demands close observation of how expert writers use words and expressions differently in different types of text, e.g. literature reviews or experimental reports in a single field (e.g. biology).

Academic papers (and most other forms of academic writing) are typically expository or argumentative. An expository or informative paper describes or explains a particular set of phenomena, and provides an account of why these phenomena are found in one or more specific situations or contexts. The goal of the expository paper is also to acquaint the reader with a body of knowledge. An argumentative or persuasive paper must choose a side, make a case for it, consider and refute alternative arguments, and aim to convince the undecided reader that the opinion it presents is the best one. You must be aware of other sides and be fair to them; dismissing them completely will weaken your own argument. It is always best to take a side that you believe in, preferably with the most supporting evidence.

To develop a good academic paper you should go through a number of stages, called the writing process. The following seven stages can be distinguished:

The writing process	
1. Thinking stage	} Planning process
2. Research stage	
3. Outline stage	
4. Drafting stage	Transfer in a first draft output
5. Revising stage	} Revising & editing
6. Editing stage	
7. Final version stage	Final output

Figure 1. Stages of the writing process

1. *Thinking stage* In this stage you determine your topic area (which may of course already be given), brainstorm about ideas on the topic, select, reject and focus those ideas, before arriving at your final choice.

2. *Research stage* Here you search for and study background literature and other materials, analyse the results, draw your own conclusions and interpretations, etc.

3. *Outline stage* In this stage you draft an outline of the paper you intend to write, setting out your main aim or purpose in the paper (the purpose statement or thesis statement), sketch how you will develop the points that follow from the purpose, and indicate how you will conclude the paper.

4. *Drafting stage* Here you put down on screen successively improved versions of your paper.

5. *Revising stage* In this stage you scan your work on a macro level for logical coherence, checking whether you need to add or delete information, whether sections need rephrasing for clarification.

6. *Editing stage* Here you edit your text on a micro level, checking the grammar, spelling, punctuation, in-text citations, references and the layout.

7. *Final version stage* In this stage you set out the final paper neatly and clearly.

Writing a paper is recursive: you do not start at the beginning, and work through straight to

the end, and that is that. At all times you will be “backtracking” or “looping”, so that as you are writing your first draft, you may discover you need to add more information and have to re- turn to the research stage. During the revising stage, you may discover that your original plan was too broad, and so decide to cut out a whole section. You may produce several revised versions of the paper before your final version. Do not forget to allow yourself plenty of time between writing your first draft and your final version. Figure 2 illustrates the three groups of actions in writing a paper, the planning process, the transfer, and revision and editing. The figure emphasizes the recursive nature of writing a paper in that each action not only feeds into the next but feeds back into the previous actions, entailing revision of those actions.

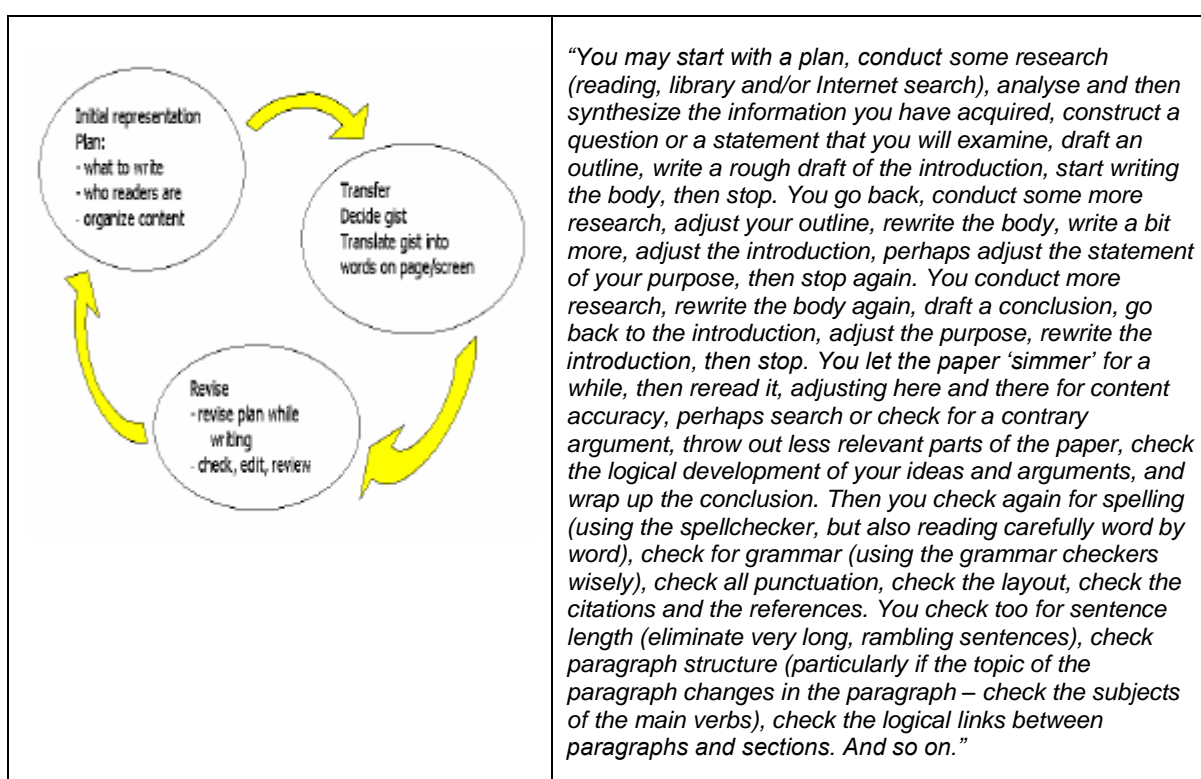


Figure 2: The writing process and its recursive nature (Bruer, 1993).

This guide is organized as follows. Chapter 2 focuses on the planning process, describing the planning activities and the construction of an outline. Chapter 3 elaborates on the structuring of the paper, through a detailed discussion of the three parts of a paper, introduction, body, and conclusion. Moreover, structuring a paper effectively requires that you write well- constructed paragraphs: this chapter also provides brief guidelines on paragraph organization. Chapter 4

explains the importance of citing sources and giving references, and provides guide- lines how to put them in the paper in a correct way. Chapter 5 concentrates on finalizing the paper. This chapter discusses the format requirements, text revision and the evaluation of the paper.

To conclude, this guide helps you to master the process of academic science writing, which you can apply to the specific writing assignments during the course of your academic studies. It specifies the elements necessary to a successful academic paper. But keep in mind two things. First, each assignment will be different and require a different organization. Second, writing is a skill; you only get better at a skill through regular practice. Regular practice leads to routine and expertise. The application of the principles of this guide can be of use until your last writing examination: your bachelor's thesis. However, this guide just contains a brief summary of the different topics discussed. For more information you should consult literature, especially the *Publication Manual of the American Psychological Association* (2010, 6th ed., in the University Library), and the Internet. Besides, keep in mind that the writing process is not just simply following a set of rules. Try to develop your own style, expertise and talent, in order to distinguish yourself.

Good luck with your writing career!

2. The planning process

In order to get a good start to writing your paper, it is important that you go successfully through the planning process. This chapter describes the different activities of the planning process. Then, section 2.2 discusses the most important stage of the planning process: the construction of an outline.

2.1. The planning activities

During the planning process, according to Hannay and Mackenzie (2002), you are concerned with six major activities:

1 Generating ideas for the content. Ideas for content can come from several sources: from your own knowledge, from discussions with other people, and from various media sources (written texts including journal articles, audio-visual media and electronic media). Brainstorming techniques help you to generate ideas in the first two categories.

2 Selecting and classifying points. Here you are concerned with ordering your ideas. Analyse them to determine the extent to which they are connected with each other. Ideas and concepts that are highly connected are likely to form key points in your texts. Those which are less closely connected may form essential supporting topics, or may need to be abandoned. Some may require more development. Always be prepared to get rid of ideas that prove not to be relevant to your argument.

3 Establishing your perspective. In this activity you need to decide what angle you are going to take with your material. Are you taking a historical perspective, or only discussing the present situation? Are you taking an objective position, or are you bringing in your own personal standpoint? Are you taking a general viewpoint, or only a specific case? Are you looking at the matter from your home country's perspective? Are you discussing a general issue or only a national situation?

4 Determining your intention. Now you need to consider what you want to do with the text. Do you want to present both sides of an argument equally, or do you want to present only one

side? Do you need to give examples, or will your argumentation be sufficient on its own? Do you want to persuade the reader of your opinion, or are you only wishing to describe the matter? Do you want just to present a problem, or do you want to offer solutions as well? What you are going to do with your text must become very clear to the reader in the thesis statement: this statement directs the readers to the purpose of the text.

5 Formulating a draft title, structuring the introduction and conclusion. Here you should set down a working title and devise a draft structure for the introduction and the conclusion. At this stage your drafting should only be provisional: you should write the actual version only after you have written the body of the paper. This is because you do need to know what your introduction is indeed introducing, and you need to know what your conclusion is concluding. A useful rule of thumb is: Plan your introduction, then your conclusion, and then your body, but write your body, then your conclusion and then your introduction.

6 Drafting paragraph themes. At this stage, go back to the ideas (themes) you have selected and classified. Now you have to decide which will be suitable for your text. Each theme usually is the basis for a single paragraph. Each theme too will require sufficient development; so do not try to include too many. As a rough guide, you probably cannot treat adequately more than about 4 themes in a 1000-word paper (roughly 3 pages), while a 2500-word paper (roughly 6 pages) will seem overwhelming if it includes more than 9 or 10 themes. Once you have selected your themes, list the points that you need to make to support the theme in the paragraph.

2.2. The planning outline

The goal of the planning outline is to help you organize your ideas, and present them in a logical order. It serves to identify the relationships between the ideas: it allows you to see how related ideas can be grouped together, and which ideas you can cut out, and which ideas need more support. A good outline helps you to maintain the direction in your paper, and prevents you from getting distracted into irrelevant information.

Figure 3 lists six steps that may be considered in the development of a planning outline.

- 1 Decide the purpose of your paper and the audience you are writing for.
- 2 Develop a statement in which you define the goal or purpose of your paper (commonly called thesis statement – but see section 3.1.2). This clarifies what you are going to present or argue in the paper. At this stage you may not have a definitive version of this statement.
- 3 List all the important points you want to handle in the paper. These points have to be split in three main parts: introduction, body, and conclusion.

The points in the introduction include the items that lead to the purpose or thesis statement (so-called background information), and a statement of the purpose or goal that should now be defined precisely. When you are planning your paper, you will group all your ideas around one central theme. This theme forms the core of your purpose or thesis statement or research question.

The points in the body have to be logically organized so that they follow from your purpose and lead towards the conclusion. In a larger paper (for example a Master's thesis), you usually develop a set of subquestions, covering the points that lead to an answer to the research question. By answering step by step the different subquestions in the body, you can draw a structured and well-founded conclusion at the end.

The points in the conclusion include the summary of the facts that lead to an answer to the statement or question you started with and the answer itself.
- 4 Categorize the points in the body under general headings so that you can identify which points need more development (e.g. you have to do more reading) and which points are not useful or relevant (delete these). Choose precise, concrete words for the headings: avoid vague terms. Relate the headings to the purpose of your paper. If your paper is describing a situation, you are more likely to choose noun structures for headings (for example: Coexistence of phases in a protein heterodimer). If your paper is oriented to action, you may choose verbal structures; typically *-ing* forms in English (for example: Assessing the two-body diffusion tensor calculated by the bead models). [Both examples are taken from *The Journal of Chemical Physics*. Note that articles in some journals begin with "On ...". This usually implies a discussion paper relating to work in progress, and would be expected to focus on theory.]
- 5 Work out how one idea follows logically from the previous one. Note down how you will make the transitions from point to point. This is a key step, but one that is often underrated. Failure to think out the transitions in the planning stage can cost you more time in the revising stage.
- 6 Finally, look back at the whole outline, and check that you are satisfied that it all hangs together logically and conceptually. Now you are ready to start writing.

Figure 3. Six steps in the planning process.

Outlines are generative. They are most useful if you modify them as you write in line with new thoughts or information. Some of you may find that a simple, less detailed written outline is sufficient—you may be very competent in holding the full structure in your mind—but you may add more detailed points to the outline as you progress. Most of you, however, find that a relatively detailed outline on paper is an effective reminder of what the goal of your paper is and of what you have selected from the literature, and an efficient guide to how far you have come.

An outline as a simple list of points (see Figure 4, box a) may not help you organize and structure your paper. A more organized outline (see Figure 4, box b) will help you see how the different parts hang together and may facilitate the writing. Many American writing textbooks and websites provide detailed guidance on writing outlines. Under the American convention, outlines are structured using the following symbols (Roman numerals [I, II, III, ...], capital letters [A, B, C, ...], Arabic numerals [1, 2, 3, ...]). This is *only a convention* used in the writing process to help organize your ideas: it is *not* part of APA style, and under no circumstances should it be used in your final papers for the Sciences (see for example Purdue University's Online Writing Lab: <http://owl.english.purdue.edu/owl/resource/544/03/>). Box c (Figure 4) illustrates the framework using the American conventions.

a Unhelpful outline	<p>Topic: Environmental pollution of the Mediterranean Sea</p> <ol style="list-style-type: none"> 1. Background of sea pollution; history. 2. Major types of pollution: Oil, sewage, plastics, ... 3. Possible solutions: technology, bacteria, human behavior, shipping, ... 4. Conclusion: weighing up the advantages and disadvantages of the solutions.
---------------------	---

Figure 4(a). Examples of outlines.

b Structured outline	<p>Genome of a songbird unveiled</p> <ol style="list-style-type: none"> 1. Introduction <ol style="list-style-type: none"> 1.1. Background to case: biological systems, neurobiological studies 1.2. Songbird as a model of imitative vocal learning: case of zebra finch 1.2. Aim of paper: to review research on zebra finch to show insights into fundamental scientific questions. 2. Development and the brain <ol style="list-style-type: none"> 2.1. genes in brain at critical developmental period 3. Auditory experience <ol style="list-style-type: none"> 3.1. Social interactions across songbird species 3.2. Sensory regulation and motor regulation 3.3. Transcriptional factors 3.4. Role of microRNAs and non-coding RNAs 4. Zebra finch genome <ol style="list-style-type: none"> 4.1. Implications of the unraveling of the genome <ol style="list-style-type: none"> 4.1.1. Genes lacking (milk-encoding, synapsin I, ...) 4.1.2. Gene duplication (growth hormone, caspase-3, ...) 4.2. Similarities and differences with chickens and humans 5. Conclusions <ol style="list-style-type: none"> 5.1. Publicly available resources for songbird studies 5.2. New insights (e.g. how identity & expression patterns of neuropeptides may be involved in brain circuits in vocal communication) 5.3. Ongoing research <ol style="list-style-type: none"> 5.3.1. leading to understanding of functional organization of songbird brain 5.3.2. leading to songbird gene expression brain atlas 5.4. Eventually: ability to test causal relationship between gene expression, cellular physiology, and behavior.
----------------------	--

Figure 4(b). Examples of outlines.

c Classic formal out- line (American style)	<ul style="list-style-type: none">I. First itemII. Second item<ul style="list-style-type: none">A. sub-itemB. sub-item<ul style="list-style-type: none">1. sub-sub-item2. sub-sub-itemIII. Third item
---	---

Figure 4(c). Examples of outlines.

3. Structuring

On the basis of the outline, described in the previous chapter, it is now possible to continue with the structure of your paper. You started the structuring process already in steps three and four of the construction of an outline, described in section 2.2. The structuring process continues by implementing these steps in the paper, starting with the introduction. Section 3.1 discusses the structuring process of the introduction, section 3.2. covers the middle part (or body – note ‘body’ is an abstract concept; never label part of your paper as the ‘body’), and section 3.3. the discussion and conclusion. Structuring a paper effectively also requires that you write well-constructed paragraphs. This is discussed briefly in section 3.4.

3.1. The introduction

The introduction has three functions, all of which must be present. First, it sets the *context* by introducing the topic of your paper. This is called the background information. This information leads to the second function: it specifies the *purpose* of the paper. Finally, the introduction contains a short *outline* of how you are going to handle the aspects of your topic in the rest of the paper. Any introduction in which one of these functions is missing is necessarily incomplete.

The length of the introduction varies from one paragraph to several pages, depending on the total length of the paper. Three other factors influence the length. First, how *familiar* are your readers with the context? If, for example, you are writing about the exploitation of salt marshes in Brittany, you may have to explain much more of the ecological background of the region for readers who are less familiar with that part of France, since the readers may wish to compare the impact of salt exploitation in Brittany with that in salt marshes in other parts of the world. Second, what the type of paper (or *genre*) are you writing? If, for example, you are writing a review of the scientific academic literature on the properties of gold nanoparticles, your introduction might be quite short, since you will include the information from your review in the middle of your paper. Your introduction will contain a brief indication of the main properties you will review, and probably some reasoning why a review is warranted at this time. Similarly, if you are reporting an experimental study from the laboratory, then you may not need much background information, for you can refer fairly quickly to the purpose of the study and the methods you used to conduct

it. On the other hand, in a paper in which you argue a point of view (e.g. for a reclassification of plant species), then you may need to present adequate background information before introducing your purpose. Third, what *subdiscipline* of which science are you addressing? The length of introductions may differ between physical chemistry, analytical chemistry, biochemistry, inorganic chemistry, and so on. It is wise to check by reading relevant previous papers in the target discipline and the target genre, as well as taking the readers' familiarity into account.

Nevertheless, as a useful rule of thumb, it is valuable to think of your introduction as being about one-eighth of the length of the text you are writing. Thus, the introduction to a 1000-word paper would be about 125 words; the introduction to a 10,000-word dissertation would contain about 1250 words, and may well appear as a short chapter in its own right. But treat the one-eighth concept as a guideline, not as a straightjacket. Typically, review papers, theoretical papers, and case studies tend to have shorter introductions.

The process of writing the introduction depends heavily on personal preference. Some writers like to know exactly how they will begin before they start to elaborate the text they are aiming to write; other writers prefer to know what they have written first, and then write the introduction to fit it, so that it leads to the purpose statement. Yet, a second good rule of thumb is to write a draft introduction that leads to your purpose statement, then write the whole text, right to the conclusion, progressively editing as you go along. Only then do you return to your introduction and adjust or rewrite it so that it does indeed fit your paper neatly and satisfyingly.

3.1.1. The background information

The introduction prepares the readers for what follows. Thus, the introduction has an *orientation* function. Thus, it should therefore present enough background information so that the readers will recognize that the middle of your paper follows logically and coherently from the introduction - you need to pay attention to what the reader can be expected to know already and what will be new. Your introduction is more effective when it progresses from the known to the unknown (Figure 5).

	Genome of a songbird unveiled
Very general background	The study of songbirds has revealed a variety of fundamental properties of biological systems. In particular, neurobiological studies carried out in songbirds have revealed the presence of newly born neurons in the adult brain, how steroid hormones affect brain development, the neural and mechanistic bases of vocalizations, and how experience modifies neuronal physiology. More evidently, however, songbirds have been extensively used as a model for imitative vocal learning, a behavior thought to be a substrate for speech acquisition in humans [1,2].
Example	
Narrowing to more specific background	Now an international consortium has unveiled the genome of the zebra finch (<i>Taeniopygia guttata</i> , Figure 1), along with a multi-layered analysis of its sequence [3]. Sequencing the zebra finch genome was initiated in 2005 under the Large Scale Genome Sequencing Program of the National Human Genome Research Institute [4], leveraging prior work in the research community characterizing the zebra finch brain transcriptome [5-7]. These initiatives, along with new zebra finch genome sequences, have resulted in the complete genome sequenced with 17,475 protein-coding genes identified, as well as regulatory regions and non-coding RNAs. The annotation and sequence coverage of the zebra finch genome will certainly be refined in the years to come, but the initial endeavor is expected to provide a unique platform for modern genomics research in this organism. Furthermore, this initial snapshot of the songbird genome should provide critical insights into fundamental scientific questions, including an array of physiological and evolutionary processes. Here, I review some of the most exciting findings of this pioneering effort.
Very recent: single case	
Details	
(Future potential)	
Purpose	

Figure 5. Example of an introduction from a journal article (review paper). Source: Pinaud, R. (2010). Genome of a songbird unveiled. *Journal of Biology*, 9, 19. doi:10.1186/jbiol222

3.1.2. The purpose statement

The purpose statement is a vital component in academic papers. It marks the high point of the introduction. This statement is a clear expression of the purpose that your paper is expected to assert, explain, support, or defend (Fulwiler & Hayakawa, 2000). It summarizes the main idea of a paper and makes that idea explicit to the readers. The statement answers the questions the critical reader has: “So what? Why does this paper exist? What’s it all about?”

In the literature on academic writing, you will meet the term “thesis statement”. This term covers the statement that the writer is going to argue in his or her paper. Strictly speaking, it is relevant to argumentative papers where you are advancing a claim (the thesis), and then in

the paper you present the arguments (evidence) that demonstrates whether the claim holds. An example of an argumentative paper is a *position paper* in which you set out a particular theoretical position (opinion) based on arguments (evidence).

Many papers that you write will not be essentially argumentative papers. You may often simply be explaining a phenomenon or showing and analysing data. Sometimes, you may simply be answering an exploratory question. However, all papers do require a statement or question that neatly summarizes what you are going to do in your paper (see Table 1).

Table 1. Types of papers and associated purpose statements*.

Type of paper	Purpose expressed as:	Explanation	Example
Argumentative paper	Thesis statement	You argue a proposition (claim). You present the arguments (evidence) for and against the claim, and decide whether the claim is supported or not.	The government decision to allow drilling for shale gas is correct because it takes into account the four key factors, environmental, economic, social, and technical.
Experimental paper	Research question; hypothesis	You start with a question about a phenomenon, and devise one or more hypotheses that you will test in your research. Your experimental paper reports the results.	How can oil and water mix? Removal of all gas from water allows spontaneous mixing of oil and water.
Exploratory data analysis	Research question	You conduct a survey or a series of interviews, for example, but do not have an explicit hypothesis before you start. You have a research question, but do not know in advance what the answers may be.	What are students' beliefs and understandings about evolution? Or: This paper explores the beliefs and understandings that students have about evolution.
Literature or practice review article	Purpose statement	Your goal is to examine what has been researched previously or what practices are used in particular scientific activities.	This paper critically reviews recent research on the utility of DNA barcoding in biodiversity conservation.
Expository paper	Purpose statement or question	Your goal is to explain a phenomenon and to inform readers about it. Your paper will mainly be presenting facts (evidence), although you may include some opinions, especially regarding your conclusions. However, your main focus is not on opinions.	This paper explores the knowledge that chemists should have about plant names. OR: Is the knowledge that chemists have about plant names adequate?

Case study	Thesis statement or purpose statement	<p>Your goal is to analyse the case and draw a conclusion. You may present your purpose as a thesis statement (proposition), which you will argue in the paper (see Argumentative paper above).</p> <p>You may decide not to argue a claim beforehand but just rely on the evidence to lead you to a conclusion.</p>	<p>The European Commission was justified in closing the North Sea to cod fishing fleets as fish stocks had been reduced to below replenishment level.</p> <p>OR:</p> <p>This paper investigates whether the European Commission was justified in closing the North Sea to cod fishing fleets.</p>
------------	---------------------------------------	--	---

* With acknowledgement to Adam Turner, personal communication, 24 June 2010.

At the same time, the purpose statement defines the scope of the body of the paper: it makes a commitment to the reader and creates expectations that the reader expects to be fulfilled. It also points the way forward to the conclusions that you will draw at the end of the paper.

Some characteristics of the purpose statement are especially important to bear in mind if you are writing an argumentative paper (i.e. with a thesis statement). The purpose statement is, characteristically, a generalization usually in one sentence (sometimes more): it summarizes the main point of your text which is then supported and developed throughout the rest of the paper. You can conceive of your purpose statement as a formula (Lynn Nygaard, personal communication, 17 June 2010):

x is y because z,

where x = the thing you are trying to saying something about (topic), y = what you are trying to say about the thing (claim), and z = the basis on which you are making this claim (logic, theory, or empirical evidence). For example, *The government's decision to cease participation in the European space project (x) is unwise (y) because it will harm astrophysics research in the country and lead to the emigration of space researchers to foreign countries (z).* This formula allows you to generate a formal purpose statement, which will help you construct your argumentative paper. It may be that the final version presents the purpose differently (e.g. *This paper argues that the government's decision to cease participation in the European space project will prove unwise.*).

Purpose statements are effective when they conform to one or more of the following criteria:

1. Imply rather than state that the discussion will follow.

The question arises whether the West should be more proactive in the fight to reduce world poverty.

Any decision to place restrictions on human genomic research should follow from a careful consideration of the risks and benefits of future research findings.

2. Use conditional constructions, to make effective, suggestive purpose statements:

If the European Union took the intentions of the Lisbon objectives seriously, its leaders would appreciate the need to invest far more in fundamental scientific research.

3. Use a question form, if that helps make your purpose statement more striking. It also implies a more balanced, neutral assessment of the topic. This style applies more to expository papers.

How are the properties of hydrogels determined by their building blocks and method of preparation?

4. Do not personalize the purpose statement: personal preferences do not usually entice the reader to read further.

5. Do not present a statement of fact or definition in your purpose statement: such statements leave no room for expansion.

3.1.3. The short outline in the introduction

Sometimes you may be required to conclude your introduction with a short outline that describes how you are going to answer the purpose statement, and how you are going to handle the aspects of your topic in the rest of the paper. This part actually describes the (remaining) structure of the paper. Figure 6 illustrates the short outline that comes after the related background information and the specification of the purpose statement:

Purpose statement	In this article we list several ways that can be used to identify Kelvin waves. We work in the framework of the vortex filament model [14], where the vortices are considered to be thin and the superfluid velocity can be calculated simply from the vortex configuration $\mathbf{s}(\xi)$, where ξ is the length along the vortex, using the Biot-Savart integral. In other words, we consider only length scales much larger than the vortex core size, a . We start with two simple cases where the definition of the Kelvin waves is obvious: straight vortex with Kelvin waves and a vortex ring occupied by KWs. In both cases the Kelvin spectrum can be determined using a simple Fourier transformation. We use these two sample cases to test other methods that have been used previously in the literature. Such methods are, for example, curvature, energy spectrum and fractal dimension.
Outline of paper	Source: Hänninen, R., & Hietala, N. (2013). Identification of Kelvin waves: Numerical challenges. <i>Journal of Low Temperature Physics</i> , 171, 485-496. DOI 10.1007/s10909-012-0749-6

Figure 6. Example of an outline paragraph in a scientific paper.

With specific regard to larger texts such as a Master's thesis or dissertation, the introduction may well form a short chapter in its own right. In such a longer text, the short outline is usually a requirement and may be expanded to a whole section, the last one in the introduction. In this section you will indicate the contents of each chapter of your Master's thesis or dissertation. When you are planning a larger paper such as a Master's thesis, you will have broken your research question down into a series of sub-questions. Now, you will usually devote one chapter to the analysis and discussion of each sub-question. Finally, after you answered each of these sub-questions in the related chapters, in the final chapter you conclude by providing the answer to the research question. The outline of your paper, described in the introduction, shows the reader the path that leads to the final answer to the research question, by concisely describing the contents of the different chapters. In the outline you mention each of the chapters indicating first what sub-question is going to be answered and why (clearly indicating the link to the previous step and the next step in answering the overriding research question so the reader can follow the line of the story) and also what issues will be dealt with.

3.1.4. The organization of paragraphs in the introduction

Although the organization of paragraphs is discussed in section 3.4, special attention has to be paid to the construction of an introductory paragraph, containing the background information, the purpose statement, and if necessary the outline. Especially, topic sentences in the introductory

paragraph demand great care. The topic sentence, usually the first sentence of a paragraph, tells the reader what the paragraph is about. After all, in the introductory paragraph the topic sentence represents the starting point for your readers, and can attract or repel them!

1. Make sure your first sentence is fairly uncontroversial —you do not want to put off or irritate immediately those readers who may disagree with you.
2. Make sure the topic sentence of the introductory paragraph is relatively ‘timeless’; that is, it should not be directly linked to the time of writing. You cannot always know when a reader is going to be reading the text. General time expressions like *in recent years* or *in the last years of the twentieth century* can be freely used, but do not use expressions like *last year*, *last week*, *this month*, *yesterday*, etc.
3. Although the topic sentence of the introduction occurs immediately under the title, the convention is that the introduction should always be seen as a fresh start. Do not make the topic sentence simply a reformulation of the title.
4. Do not make the topic sentence depend on the title for its interpretation: as a rule, the first sentence should not refer back to the title.

Elaboration sentences explain or exemplify the topic stated in the topic sentence (see below section 3.4). There are two key functions for the elaboration sentences in an introductory paragraph: to *contextualize* the topic and to indicate the *perspective* from which it is viewed.

Contextualizing means providing sufficient background against which your subsequent argument can unfold. This may concern simple matters of time and place. But note the following points:

Readers will assume you are writing about the present unless you clearly indicate otherwise.

Readers of texts in English may assume the texts refer to the English-speaking environment unless you specifically indicate otherwise. Make sure, for instance, that specific references to a German, Dutch or Spanish context are clear for non-German, non-Dutch or non-Spanish readers. However, this may be less of an issue when you are writing about topics in the sciences.

Perspective concerns the angle you wish to adopt to your subject. For example, if you are writing about lanthanide chemistry, it may be wise to indicate whether you are addressing the topic from a physics perspective, or from a chemistry perspective.

In the elaboration, especially in short papers, you will often have to indicate the areas of the topic that you cannot cover in the text. Preferably, do this by focusing on what you will be dealing with, rather than going on at length about things you will not discuss. An expression like *of particular interest* enables you to focus on the topic you are dealing with, but at the same time implies that there are other aspects which are, for current purposes, of less interest.

3.2. The middle sections of your paper

The middle part of the paper, or body, is the meat in the sandwich as it were. As indicated earlier, 'body' is simply an abstract term used to refer to this part of the paper. In step four of the construction of an outline (as discussed in section 2.2), you categorized the points in the body under general headings to identify which points need more development and which points are not useful or relevant. Now, you choose specific headings that relate to the different sections you mention in the short outline of the introduction. Then, you define the different subsections and related headings to finalize the structure of the body. However, too many headings in a short paper do not help the readability of your paper: on the contrary, they appear as a series of unconnected chunks of information and give the impression of an unfinished set of notes.

You may find it valuable to use Arabic numerals to number each section and subsection. This is common practice in many disciplines, and some journals may require it. For your academic work, check the format requirements that Maastricht Science College has laid down.

The body must logically follow from the purpose statement, and you must develop the points adequately and sufficiently to elaborate, support or refute your purpose statement. The body must be organized under *clear content-relevant headings*: never use the term "body" as a label for the section in your papers. The content in the body must be written in clear, logical paragraphs. Note that in some science papers, the paragraphs may be quite short.

Where necessary, the content should be supported by exhibits (figures, tables, charts, photo-

graphs, etc.). Try to refer to the exhibit in the text first before it appears on the page. Ensure that you explain the important features of the exhibit in the text —do not leave your readers to work it out for themselves, for they could well draw different conclusions. In general, the exhibits are usually labelled “Table” or “Figure”. Number these tables and figures consecutively, but separately.

The middle part of a paper is usually the largest, approximately three-quarters of the total length. In most papers that you will write for your studies, you will need to indicate the different sections of the middle part by giving appropriate *subheadings*. In very short papers (i.e., under about 800 words), however, you may not need to use subheadings for the different sections — the text is short enough.

Ideally, your paragraphs should derive from the outline of the arguments you wish to present in your paper. However, you may wish to split a long paragraph in two. If so, ensure that each of the two new paragraphs is internally consistent: that is, they both have topic sentences and adequate elaboration. Similarly, you may wish to join two short paragraphs, and the same considerations apply. Aim to ensure that your paragraphs are *well-balanced* in length. It is helpful to take a look at the visual impact of the text on the page. A whole page without a paragraph break is likely to put a reader off.

The direction you take in the body of your paper will be determined by the approach you have adopted. This indicates the overall organizing principle of your paper. For example, a review paper on the history of the NASA space programme is likely to be controlled by a *chronological* structure. Each paragraph will deal with events in clearly delimited periods of history. In contrast, if your perspective in a similar paper on the history of the space exploration is from an analysis of the rivalry between different countries and organizations, you may adopt an *opposition* structure. In this case, you may contrast the different approaches to space exploration taken by various countries and specify these in separate paragraphs. A third organizing principle is that of *relative strength*, where you are asserting a particular claim (in your purpose statement) and you then order the pieces of evidence in terms of their strength. This may apply to a paper in which you assert that space programmes are beneficial for emerging and developing countries.

3.3. The discussion and conclusion

Many papers you write will conclude with a section called *Discussion and conclusions* or simply *Discussion* or sometimes just *Conclusion*. In papers where you present empirical or experimental data in the middle part, you do not usually discuss your results in that part, but in the *Discussion*. This is where you interpret and account for the results. In argumentative papers, especially position papers, your argument is in the middle part of your paper, and you may simply need a *Conclusion* section. The same applies to most literature reviews and theoretical papers.

Naturally, a paper must close with an effective conclusion. The conclusion finally provides the answer to the purpose statement. In longer papers, e.g. Master's theses, where you have a longer discussion of the evidence, then the answer to your research question may be presented over several paragraphs. In short papers, the conclusion may be a single paragraph. The concluding paragraph is organized in the following way.

The topic sentence of a concluding paragraph must serve as notice that the body is over and the conclusions are about to be drawn. Note that the signalling words *so*, *however*, *thus* and *therefore* are too weak to signal the change from body to conclusion. Other signals, such as *to conclude*, *by way of conclusion*, *to sum up* are clear, but may be too explicit, especially in short papers.

In short papers, adverbs seem to work best for this purpose, such as *certainly*, *clearly*, *indeed*, *arguably*, *undoubtedly*. However, pay particular attention to your choice of words here, since if you say "clearly" and it is not clear to the reader at all, then you may find your work gets rejected. In longer papers, indicate the conclusion by a clear heading.

The elaboration of the conclusion conventionally covers three functions: first, a summary should be given of what has been presented in the middle part (body). This summary leads to the second function, the answer to or resolution of the purpose statement. Finally, you should indicate your own interpretation of the conclusion: this is your judgement or opinion, but aim to express it in a non-personal way.

An effective final sentence is striking and memorable, and so ends the paper on a communicatively important and positive note. It should not depend for its interpretation on the

preceding sentences. It should stimulate the reader to think further. So, where possible, take care that the conclusion ends strongly (Figure 7).

As a useful guide, the conclusion should comprise about one-eighth of the whole text; thus in a 500-word paper the conclusion should not be more than about 60-70 words, i.e. one single paragraph, usually without a heading. In a larger paper (e.g. 2500 words), the conclusion may consist of several paragraphs. In a Master's thesis, for example, it will form a separate chapter.

<p>Summary</p> <p>Further issues (for further research)</p> <p>Potential outcome in future</p>	<p>8 Conclusions</p> <p>Here we have presented several methods that can be used to identify Kelvin waves. In case of a straight vortex or a vortex ring the identification can be done most reliable. However, in case of vortex tangle a great care should be used. The biggest problem is the lack of proper definition of a Kelvin wave on a curved vortex. In order to properly define a Kelvin wave there must exist a scale separation between the characteristic size of the underlying vortex and its disturbances.</p> <p>Generally the Kelvin cascade to smaller scales can be qualitatively identified using, <i>e.g.</i> average curvature. An accurate determination of the Kelvin amplitude is still very demanding and can result in large errors, depending on the numerical method used. It is alarming that some numerical methods can result in a spectrum that is totally incorrect but still very close to the spectrum predicted theoretically. Therefore, all methods should be properly tested using a simple configuration where the spectrum is known in advance.</p> <p>The highly dominating geometrical $1/k$ scaling in the 3D energy spectrum at high-k illustrates that at small scales the determination of the vortex location becomes much more essential than the knowledge of the energy spectrum. Only after determining the vortex location, we have some hope for identifying the Kelvin spectrum. Identifying the vortex location is not a problem with the vortex filament model and is quite straight forward with the Gross-Pitaevskii equation. Experimentally the identification is challenging but recently the visualization of quantized vortices has become possible [23].</p> <p>Furthermore, the accuracy of the numerical schemes typically limits the proper determination of the Kelvin spectrum to scales $k \leq k_{res}/5$, or even less. Similar requirement results from the dissipation, which must be present in order to avoid numerical bottleneck that would otherwise generate a non-physical fractalization of the vortex at the smallest scales. Therefore, the identification of Kelvin waves on a tangle is a great challenge and requires resolution that is much higher than the average vortex separation. Here faster computers and especially new numerical algorithms, like the tree method [24], are of great importance.</p> <p>Source: Hänninen, R., & Hietala, N. (2013). Identification of Kelvin waves: Numerical challenges. <i>Journal of Low Temperature Physics</i>, 171, 485-496. DOI 10.1007/s10909-012-0749-6</p>
--	--

Figure 7. Example of a conclusion section from a science paper.

3.4. The organization of a paragraph

Paragraphs are not the same as sections. Papers are divided into sections, and a section is organized into paragraphs. Paragraphs are the organizing units of writing, indicating which ideas go together and how they relate to each other. Good paragraphing gives readers clues to how to read your paper. Moreover, the visual impact of paragraphs on the page or screen helps show the reader when you have moved on to the next step in your ideas. Readers expect your paragraphs to be *unified* —that is, each paragraph discusses one main issue. They also expect your paragraphs to be well *organized* —in that the development of the ideas follows a clear order. Finally they expect your paragraphs to be *coherent* —so that each sentence logically follows from the previous ones, in advancing and supporting the topic of the paragraph. Always ask yourself: how does this paragraph fit in the whole paper?

The paragraph starts with the so-called *topic sentence*, and subsequently, treats the issue in a series of linked sentences: the *elaboration*. The high point of the paragraph comes at the end, the *closure*, which concludes the paragraph. If you do not fulfil these three components of a paragraph, you leave your reader with a feeling of incompleteness and dissatisfaction. Avoid using one-sentence paragraphs. The one-sentence paragraph is a technique that should, as a rule, not occur in a paper. It is a technique of informal writing, e-mails, webpages, manuals, guides, correspondence and of some types of popular journalism, but, with rare exceptions, has very limited place in academic science writing.

3.4.1. The topic sentence

The foundation of every paragraph is of course the initial sentence, the topic sentence. This sentence has two functions. First, it announces the topic of the paragraph, i.e. what the rest of the paragraph will deal with. A paragraph will be internally coherent if all sentences in that paragraph fall under the scope of the topic sentence. Secondly, it relates the paragraph to the surrounding text, especially to the preceding material (Hannay & Mackenzie, 2002). The topic sentence helps the writer and the readers to grasp the issues (the topic) being discussed in the paragraph (Figure 8). When you check your work, you can quickly see whether information in the sentences of the paragraph are all related to the topic, or whether some information needs to be deleted or moved to a different paragraph, or even whether a paragraph needs splitting in two.

Topic sentence	<p>The current model is based on the application of percolation theory to space–time. A subset of percolation models (random resistor networks) yields a simplified relationship between mass and time, where these parameters are substituted for resistance and current, respectively. The important features of the model include infinite scalability and a robust mechanistic rationale for the Newtonian constructs of gravity, inertia, and uniform mass acceleration in a gravitational field, as well as the relativistic concept of time dilation in response to mass and velocity. None of the underlying postulates of the current model are completely new. The possible existence of extra dimensions of time has already been discussed,¹⁸ and the concept of pores is based on the idea that there is a lower limit to the amount of space that contains measurable information.²</p> <p>Nevertheless, the use of these postulates in the context of percolation models provides an entirely novel framework for relating mass, time, and motion.</p> <p>Source: Cantor, J. (2012). Application of a random resistor network model of space-time to various physical phenomena. <i>Physics Essays</i>, 24(4), 484-487. DOI: 10.4006/0836-1398-25.4.484</p>
Elaboration	
Closure	

Figure 8. Sample paragraph illustrating the topic sentence, the elaboration sentences, and the closure.

3.4.2. The elaboration and closure

The largest part of the paragraph is the elaboration of the topic sentence, the part of the paragraph that offers the most information. The final sentence is the closure. It may be explicitly linked to the topic sentence, but is never a mere restatement (see the link in Figure 8 above). Rather, it serves to state the point, to make clear the cognitive gain of the paragraph and can sometimes point ahead to the topic sentence of the next paragraph.

We can distinguish seven different types of elaboration (Hannay and Mackenzie, 2002), depending on the communicative goal of the paragraph.

1. Spatial elaboration
2. Temporal elaboration
3. Analytical elaboration
4. Deductive elaboration
5. Inductive elaboration

6. Dialectical elaboration

7. Enumerational elaboration

1 *Spatial elaboration* is found in paragraphs whose goal is to describe some aspects of reality, especially the spatial configuration of things and places. Such paragraphs typically have a topic sentence that introduces the location, an elaboration that takes the reader on an imaginary journey around the area being depicted, and a closure sentence that identifies some point as being of particular importance for the ensuing text. Although this type is frequently found in tourist guidebooks, it is not so common in academic writing, but may well be found when describing entities in biology, for example (Figure 9 gives a partial example).

Topic sentence (whole)	FGFs are small proteins (between 17 and 34 kDa) characterized by a relatively well conserved central domain of 120 to 130 amino acids. This domain is organized into 12 antiparallel β sheets forming a triangular structure called beta trefoil. In general, FGFs function through binding to a tyrosine kinase receptor (FGFR) on the surface of the cell membrane. Two FGF ligands bind a dimeric receptor in the presence of heparan sulphate proteoglycan (HSPG) allowing the transphosphorylation and activation of the intracellular tyrosine kinase domain of the receptor. Binding to FGFRs usually activates several intracellular cascades (i.e., Ras/MAPK, PI3K/Akt, and PLC γ /PKC) which may regulate the transcription of different target genes. Through the activation of these cytoplasmic pathways, the FGF signal controls several major cellular functions such as cell proliferation, migration, differentiation, or survival. An intracellular mode of action has also been described in the case of FGF1 but it is poorly documented [3].
Elaborations (parts – narrowing)	Source: Oulion, S., Bertrand, S., & Escriva, H. (2012). Evolution of the FGF gene family. <i>International Journal of Evolutionary Biology</i> , doi:10.1155/2012/298147

Figure 9. Spatial elaboration (partial).

2. *Temporal elaboration* is used where various pieces of historical evidence are cited for the claim made in the topic sentence (Figure 10). Just as the body as a whole should show chronological sequencing, so the paragraph should give the succession of events in the order of their actual occurrence in time. The closure sentence should present the historical high point of the time period under discussion.

Topic sentence (claim)	<p>Several carcasses and even captured specimens further demonstrate the occasional presence of non-native cats within the British countryside. Although it can be argued that these individuals represent mere rare escapees –present in the British countryside for a fleeting span of time – it remains little appreciated that the existence of such escapees both verifies and potentially explains – in part – the ‘British big cat’ phenomenon. Two lynxes were reportedly shot in Scotland during the 1920s and apparently sent to London Zoo (Shuker 1989); their current whereabouts are unknown. A Eurasian lynx was shot by a farmer in Suffolk, 1991: the carcass was photographed (Shuker 1995) but was buried in an unknown location. Five Leopard cats have been killed or captured in Britain and two dead Jungle cats (Hayling Island, 1988 and Shropshire, 1989) have been recovered (Shuker 1989; Minter 2011). In 1980, a live Puma was captured at Cannich, Inverness-shire; the animal’s scat showed that it had been living wild for an extended period (Shuker 1989). A live Eurasian lynx was captured in London in 2001 (Minter 2011). It is not doubted that these animals were escapes (or, in cases, possibly deliberate releases) from captivity. A popular hypothesis is that exotic felids were only released into the British countryside following the introduction of the 1976 Dangerous Wild Animals Act. However, sightings that substantially pre-date 1976 cast doubt on the idea that this one piece of legislation explains all exotic felid releases in the UK: it seems more likely that escapes and releases have occurred throughout history, and that this continual presence of aliens explains the ‘British big cat’ phenomenon.</p> <p>Source: Blake, M., et al. (2013). Multidisciplinary investigation of a ‘British big cat’: a lynx killed in southern England c. 1903. <i>Historical Biology</i>, http://dx.doi.org/10.1080/08912963.2013.785541</p>
Chronological sequencing (more or less)	
Closure	

Figure 10. Temporal elaboration.

3. *Analytical elaboration* occurs where the topic sentence presents a generalization and the following sentences serve to particularize, exemplify or specify that generalization. After a topic sentence such as: *all the major religions of the world have underrated the potential of their female adherents*, the elaboration sentences would then provide examples of how this applies to each of the world’s most important religions. The closure sentence would both add more detail to the topic sentence and link in naturally with a following paragraph. Analytical elaboration does not necessarily entail a closure sentence (Figure 11, although it also serves as an exemplification paragraph).

Topic sentence (generalization)	<p>Methyl transfer from an electrophile to a nucleophile by an S_N2 mechanism is a significant reaction in chemistry and biochemistry. Up to now, it is still the subject in many experimental and theoretical studies [1–10]. In the organometallic chemistry, the methyl transfer plays an important role because of its involvement in the homogeneous and heterogeneous catalysis and organic synthesis [11–13]. In the gas-phase chemical reactions, the methyl transfer has always been a popular study. For example, O’Hair’s group has reported the methylation of some pyridine derivatives and amino acids in the gas phase and studied the differences in the methylated loci [14–16]. Brodbelt’s group has investigated the methylation of the nitrogen atom in different hybridization states [17]. In biochemistry, transmethylation is an important process and the mechanism of its enzymic catalysis is of great interest, such as the conversion of homocysteine to methionine and the methylation of glutamate residues in chemoreceptors and gene regulation [18–20].</p> <p>Source: Zhang, X. (2013). Methyl-to-double bond transfer in the gas phase: A theoretical study. <i>Computational and Theoretical Chemistry</i>, 1020, 7-13. http://dx.doi.org/10.1016/j.comptc.2013.07.015</p>
Elaboration	
Particularizations (as support for the generalization)	
Closure	

Figure 11. Analytical elaboration.

4 *Deductive elaboration* is found where the topic sentence tends to make an assertion that has some obvious validity and the elaboration develops the logical consequences of that assertion (Figure 12). For example, a topic sentence like: *language is a vital tool of human communication*, would be followed by elaboration sentences such as: *any study of language must therefore take account of its role in communication*. The closure of the paragraph takes the form of a conclusion to the argument presented in the elaboration: *it follows that every effort should be made to elaborate a functional theory of language*.

Topic sentence (assertion; in this case hypothesis)	<p>In our hypothesis, an ancestral FGF gene (named FGF3/4/5/6) was duplicated in tandem before chordate diversification. Such duplication might have occurred before eumetazoan diversification or specifically in the chordate ancestor. Thus, the putative ancestor (either eumetazoan or chordate ancestor) had two FGF genes maintained in cluster: FGF3 and FGF4/5/6. This situation can still be observed in the cephalochordate <i>Branchiostoma floridae</i> in which FGFB and FGFE are clustered in a genomic region showing synteny conservation with the vertebrate locus containing the FGFs 3, 4 and 6 [19] (Figure 3). This hypothesis</p>
Deductions from hypothesis	

Closure (conclusion)	<p>implies a loss of FGF3 in different lineages, the number of lineages that lost FGF3 depends on the timepoint at which this gene appeared (i.e., in urochordates in one hypothesis (Figures 2(b) and 5), or in urochordates, ambulacrarians, protostomes, and cnidarians in the other hypothesis, see Figure 5). According to this scenario the origin of FGF3 would be ancient (i.e., at least prior to chordates diversification) and not due to the vertebrate-specific genome duplications.</p> <p>Source: Oulion, S., Bertrand, S., & Escriva, H. (2012). Evolution of the FGF gene family. <i>International Journal of Evolutionary Biology</i>, doi:10.1155/2012/298147</p>
----------------------	--

Figure 12. Deductive elaboration.

5. *Inductive elaboration*, by contrast, occurs when the topic sentence makes some claim, the validity of which is not immediately obvious, and the subsequent elaboration presents evidence to support the claim. A topic sentence such as: *the world is a safer place today than it has ever been*, would be followed by elaboration sentences such as: *the Soviet Union, the major threat to world peace, no longer exists*. The closure sentence offers a (typically positive) evaluation of the evidence (Figure 13).

Topic sentence (claim)	<p>Lynxes (and other felids) can undoubtedly survive in the British countryside without problem. This assertion is demonstrated not only by the lynx, puma, leopard cat and jungle cat specimens discussed here, but also by the survival in the wild of a Clouded leopard (<i>Neofelis nebulosa</i>) that escaped from Howlett's Zoo in 1975 and then survived for 9 months until shot by a farmer. We feel that the discovery of the Newton Abbot lynx is worthy of note as it verifies the presence of a medium-sized nonnative cat long prior to the implementation of the 1976 Dangerous Wild Animals Act. This provides further support for the proposal that non-native felids have been an occasional but continuous presence in Britain for decades.</p> <p>Source: Blake, M., et al. (2013). Multidisciplinary investigation of a 'British big cat': a lynx killed in southern England c. 1903. <i>Historical Biology</i>, http://dx.doi.org/10.1080/08912963.2013.785541</p>
Evidence	
Closure (evaluation)	

Figure 13. Inductive elaboration.

6. *Dialectical elaboration* involves presenting two sides of an argument in one paragraph. The topic sentence (plus possibly one or two further sentences) advances the proposition to be discussed, the elaboration offers the counter-argument (Figure 14). Finally, the closure sentence can then contain the synthesis of the two; a resolution of the opposition that

preserves some- thing of both sides of the argument. For example, a paragraph might begin: *many people consider that the high fees charged by medical specialists are contributing to the difficulties being experienced in financing health care.* After a couple of sentences amplifying this side of the argument, you can switch to the counter-argument: *it must be conceded, however, that these specialists have invested many years of their lives in attaining their high degree of expertise and moreover incur many expenses that are not immediately visible to outsiders.* Again after a couple of sentences elaborating the counter-argument, the closure synthesizes both viewpoints: *the answer lies in moderating the fees, but also in making visible the hidden expenses with a view to reducing them and maintaining the specialists' standard of living.*

Topic Argument A	<p>Assumption 4 is that cognition is computation because of the Church–Turing thesis [51, 52]. The Church–Turing thesis says that any function that is computable in an intuitive sense is recursive or, equivalently, computable by some Turing machine [40, 53, 54].¹ Since Turing machines and other equivalent formalisms are the foundation of the mathematical theory of computation, many authors either assume or attempt to argue that all computations are covered by the results established by Turing and other computability theorists. But recent scholarship has shown this view to be fallacious [29, 55]. The Church–Turing thesis does <i>not</i> establish whether a function is computable. It only says that <i>if</i> a function is computable in a certain intuitive sense, then it is computable by some Turing machine. Furthermore, the intuitive sense in question has to do with what can be computed by following an algorithm (a list of explicit instructions) defined over sequences of digital entities. Thus, the Church–Turing thesis applies directly only to <i>algorithmic</i> digital computation. The relationship between algorithmic digital computation and digital computation simpliciter, let alone other kinds of computation, is quite complex, and the Church–Turing thesis does not settle it.</p> <p>Source: Piccinini, G., & Scarantino, A. (2011). Information processing, computation, and cognition. <i>Journal of Biological Physics</i>, 37, 1-38. DOI 10.1007/s10867-010-9195-3</p>
Transition (<i>but</i>) Argument B	
Closure	

Figure 14. Dialectical elaboration.

7. *Enumerational elaboration*, finally, is encountered in those paragraphs in which the topic sentence serves merely to quantify the points that are to be made in the elaboration (Figure 15). After a topic sentence like: *there are five arguments in favour of abolishing capital punishment in the USA*, the elaboration must then contain exactly five distinct arguments against the preservation of capital punishment. Enumerational paragraphs often lack a closure sentence. If they do have one, then it usually picks out some justification for presenting the various arguments in combination: *these arguments, taken together, call for an immediate*

implementation of a ban on capital punishment.

<p>Topic sentence (quantification)</p> <p>Elaboration (examples of the point made in the topic sentence)</p>	<p>Among the seven original articles in this special issue, four were <i>Drosophila</i> studies. Two of them focus on the mechanisms of reproductive isolation. A. Takahashi et al. in “<i>Cuticular hydrocarbon content that affects male mate preference of Drosophila melanogaster from west Africa</i>” identified a polymorphic chemical cue involved in mate recognition between sibling species. Y. H. Ahmed-Braimah and B. F. McAllister in “<i>Rapid evolution of assortative fertilization between recently allopatric species of Drosophila</i>” described an example of postmating/prezygotic isolation, where heterospecific fertilization after mating is compromised due to disruptions in sperm storage and motility. Often, reproductive isolation evolves more rapidly than any morphological traits so that the only way to distinguish recently diverged species is through mating experiments. Y.-F. Li et al. in “<i>DNA barcoding and molecular phylogeny of Drosophila lini and its sibling species</i>” showed that molecular variation can also be widely shared between sibling species despite strong reproductive isolation between them. To understand why reproductive isolation can evolve so rapidly compared to other traits, L. Müller et al. in “<i>Inter- and intraspecific variation in Drosophila genes with sex-biased expression</i>” examined the evolution of gene expression and protein sequences and found that genes with male-biased expression tend to diverge rapidly compared to the rest of the genome.</p> <p>Source: Sawamura, K., Ting, C.-T., Kopp, A., & Moyle, L.C. (2012). Mechanisms of speciation. [Editorial]. <i>International Journal of Evolutionary Biology</i>, doi:10.1155/2012/820358.</p>
--	---

Figure 15. Enumerational elaboration. This example comes from the editorial is a special issue of a journal: in this case the editors are simply listing and classifying the articles that appear in the issue with brief comment.

4. Citation of sources

Citation is the process of giving due credit to the sources of facts, opinions and ideas that you refer to in your writing. If, for example, you find an interesting fact in a book, journal article, webpage, or other publication, and you want to use it in your paper, then you must indicate in your paper exactly where you got the information. If you report an author's opinion, hypothesis, or idea, you must also give due mention in your paper. You always cite the source you use. If you describe work by Gerald M. Edelman¹ on cognition and the mind in your paper, and you used an introductory textbook on the mind, then do not cite the original book of Edelman, but cite the textbook you used. Figure 16 presents an example of appropriate citation of sources.

Two separate sources, one with 2 authors, the other with 5 authors.	<p>Our initial interest in the lynx specimen analysed here was inspired by the possibility that evidence for late-surviving Eurasian lynx, <i>L. lynx</i>, specimens might be sought in extant museum collections. Until recently, <i>L. lynx</i> was regarded as a prehistoric component of the British fauna that failed to survive beyond the end of the Pleistocene. Since 1999, radiocarbon dating of several British lynx specimens has shown that Eurasian lynxes persisted until far more recently. Specimens from Devon and Derbyshire have provided dates of 8800–9500 years before present (Coard & Chamberlain, 1999; Bronk Ramsey, Higham, Owen, Pike, & Hedges, 2002), whereas a lynx discovered at Reindeer Cave, Sutherland, is approximately 1770 years old and was hence alive in the third century AD (Kitchener & Bonsall, 1997). Lynx bones from North Yorkshire revealed even younger ages of about 1550 years old, dating these specimens to the fifth or sixth century (Hetherington, Lord, & Jacobi, 2006). Hetherington et al. (2006) noted that references to the lynx in seventh century lullabies and stories hinted at its survival within the region at this date, a possibility perhaps strengthened by the fact that north-west England was densely forested at time.</p> <p>Source: adapted from Blake, M., et al. (2013). Multidisciplinary investigation of a 'British big cat': a lynx killed in southern England c. 1903. <i>Historical Biology</i>, http://dx.doi.org/10.1080/08912963.2013.785541</p>
One source with 2 authors.	
One source with 3 authors. Then repeated in text.	

Figure 16. Example of appropriate citation of sources. Note the difference between a citation in parentheses and a citation in the grammatical structure of the sentence (last instance – in this case, a second mention).

¹ Gerald M. Edelman was awarded the Nobel Prize for Physiology/Medicine in 1972 for his discovery of the chemical structure of antibodies.

4.1. The importance of citation

Three main reasons may be identified why (correct) citation is that important in academic writing, and why you need to check carefully that what you tell in your story of the information from your cited authors is an accurate representation. First, you demonstrate your understanding of the different concepts that you have learned and afterwards applied in the text. Secondly, the reader can retrieve the different sources you refer to in the text for further research or other purposes. You too would be very grateful when you are conducting the research of your final thesis if you could easily retrieve the sources from another author's work. The third reason is to avoid being charged of plagiarism. This last reason may need some further explanation.

Plagiarism is the deliberate or unintentional reporting of facts, opinions, ideas, etc., as though they were your own. It is a serious academic offence that may have some serious consequences.

You may think that academic knowledge is shared, objective knowledge, and is therefore a kind of communal property. Nothing could be further from the truth. When anyone invents something or discovers some new fact, he tries to register that invention or that fact under a patent or through the copyright acts. Music, logos, commercial ideas can all be protected as the intellectual property of the inventor, and these are protected because they are the source of livelihood for the inventor. If the rights are infringed, then the inventor or owner of the rights can take legal action. The same principles apply to academic facts, ideas and opinions: although few academics will make money out of them directly, this academic knowledge does underpin their jobs and career prospects. In the same way, your ideas will lay the basis for your own careers.

While academic knowledge is freely available, it is necessary to give due credit to the source of that knowledge. That makes your own work academic.

Why might you fall into the trap of plagiarizing? Firstly, you may do so unintentionally. You have forgotten where you found the information, because you have read so much. The solution is to keep careful records of the sources of information that you need for writing a paper. Another unintentional reason is that you may have a false idea of what it means to write a paper. A paper is not simply the assembly of lots of facts and ideas gathered from various

sources, and your task is just to put them together. That would be a collection of notes. A paper implies that you are telling your story about that facts and ideas, and you need to identify which pieces of information are yours and which are your sources. Similarly, you may be rather unsure about what is “common knowledge” and what is specific knowledge for which you need to cite a source. This grey line between these areas is difficult to determine, especially at the beginning of your studies. However, the more you advance in your studies, the more you will discover what is the shared common knowledge —you find it as the background in lots of textbooks and articles. In the early stages of your studies, it is wise to cite all the authors of sources, just to be on the safe side.

Secondly, you may plagiarize because you think your own writing is not good enough. While using other people’s work to learn how to write can be beneficial, plagiarism itself will not help you produce a good writing. What you need to do is to learn how to express other people’s ideas in your own words, by trying different structures, by distilling the gist of what an author wants to say and then saying it in your words.

The third reason for plagiarism is much more serious. This is deliberate: you may be under time pressure, or you have other priorities, so you decide simply to copy chunks of text from the sources you read, and pass it off as your own work. This is of course easy to do with electronic sources. The trouble is, though, that usually it is also easy to spot: the style of writing changes, the relevant references do not appear in the text as they should, and errors of grammar and interpretation are simply repeated in your work. Worst of all, it does not help you acquire an effective understanding of the sources, nor does it help you develop your own writing style.

Closely associated with this is plagiarizing other students and self-plagiarism. You may not think of this as plagiarism; after all, it is just copying text that is not copyright. You may think another student’s work is hardly intellectual property, but it is. Similarly, if you have submitted your own work for one course, you may not submit it again for assessment in another course. This would also be plagiarism. This kind of activity eventually leads to the culprit being excluded from the academic community for life. In the end, doing this means you have destroyed your potential academic career.

Clearly, then, while plagiarizing may sometimes seem like the economically viable option in the

short term, in the end it is simply not worth your while. The consequences for your academic studies and career and for you as a person are too great.

Maastricht University is introducing a university-wide anti-plagiarism policy. Check both the main website of the university as well as on Eleum: see “MSC students > Forms and Materials > MSC Rules and Regulations paragraph 5.7 Fraud” to ensure that you are familiar both with what plagiarism is and how you can avoid committing it.

4.2. Systems for citing and referencing

There are many systems for citing your sources in your text and for establishing the reference list at the end of your paper. You will have noticed that the examples cited in previous chapters use different systems. We can divide the systems into those that use numerical identification in the text (and then list the references by number at the end) and those that use an author + year date system (and then list the references in alphabetical order by first author at the end). Most of the well-known systems originated in the USA, where researchers in various disciplines seem to have been the first to standardize a system. Examples of well-known numerical systems are the ICMJE (International Council of Medical Journal Editors), commonly known as “Vancouver” style (www.icmje.org), CSE or CBE (Council of Biology Editors changed its name to Council of Science Editors) (www.councilscienceeditors.org), and SIAM (Society of Industrial and Applied Mathematics) (<http://siam.org>). You will have noticed variations in the numerical systems, such as superscript ^{1,2} or use of rounded or square brackets (1), [2]. However, individual journals often vary slightly in their practices and may deviate in little ways from the “agreed” standard.

The author + date systems are equally numerous. Sometimes this is referred to as “Harvard style”, but beware that there is no single system called “Harvard style”. Here the best known are APA (American Psychological Association), which is used in many of the social and applied sciences and in some sciences too (www.apa.org), Chicago style (www.chicagomanualofstyle.org) which is used in some of the humanities, and MLA (Modern Language Association) which is used in some language disciplines including literature studies (www.mla.org). The APA Publication Manual is one of the most complete style guides and is regularly updated. It is published as a book and is widely available in Maastricht University library. It is officially not available electronically, although many universities have published their guides to APA style. Do check that you are consulting the 6th edition, as there were many highly significant changes from the previous edition.

Although it is likely that you will have to write papers according to different style guides, even during your bachelor's degree, Maastricht Science College has decided that for the purposes of your current training in the Bachelor's phase, you are obliged to follow the APA style. What follows in this chapter is a description of the citing and referencing system according to APA 6th edition. Beware that it is not simple and takes time to get right. It can be seen as a technicality for writing and publication, but technicalities need to be correct. However, once you have mastered it, then you always follow the same principles.

4.3. How to cite information from other sources

This section covers the different techniques you can use to cite information from the sources you use. One choice you will make is whether to cite information by paraphrasing, summarizing, and using a direct quote (subsections 4.3.1. and 4.3.2.). Your second choice is whether to insert the citation in the grammatical structure of the sentence or to place it in parentheses after the information cited (subsection 4.3.3.).

Word processing programs such as Word do have a facility that allows you to automatically set your citations and references into the reporting style you wish, including APA. However, if you use this mechanism, take care that you check every entry carefully. Most of the time (in this author's experience) students who use it get almost every entry wrong. A system is only as good as the initial input.

Similar comments apply to the EndNote software, which you may be familiar with. It is available from the University Library. It does work well, especially if you source all your cited resources via the databases in the library, such as EBSCO, Silver Platter, ERIC, and others. However, the same rider as above applies: The outcome is only as good as the initial information in the database. So you should check carefully all citations and references.

4.3.1. Paraphrasing and generalizing

The preferred way to cite work by other authors is to write down the information you have found from another's work *in your own words (paraphrasing)*. This can be done in two ways. In one way, you try to summarize those particular parts of another's work that are important to your paper. You summarize in your own words, because you are telling your story: you are interpreting the information you have found in the literature in the light of your conception of

the topic. See Figure 16 at the start of section 4 (last two citations).

The other way is when you find several books or articles that discuss the same aspect of your topic: here you try to generalize from the several sources by summing up the general finding or conclusion that you draw from those works. See Figure 16 at the start of section 4 (first citation with two sources).

4.3.2. Direct quotes

When you are citing information from an author, you may do so in three ways. First, you can *directly quote* an extract from the author, putting the quotation in quotation marks (“inverted commas”). This way is not very common in many social scientific disciplines, but is used, for example, for important definitions. Indeed, quotes are relatively rare in the sciences. Incorporate direct quotes of less than 40 words within the sentence of your text (see Figure 17).

The best-known application is Shannon’s own: communication theory. Shannon was looking for an optimal solution to what he called the “fundamental problem of communication” (1948, p. 379), that is, the reproduction of messages from an information source to a destination.

To tackle the meaning relation, we begin with Grice’s distinction between two kinds of meaning that are sometimes conflated, namely, natural and nonnatural meaning (1957). Natural meaning is exemplified by a sentence such as “those spots mean measles,” which is true—Grice claimed—just in case the patient has measles. Nonnatural meaning is exemplified by a sentence such as “those three rings on the bell (of the bus) mean that the bus is full” (1957, p. 85), which is true even if the bus is not full.

(Source: adapted from: Piccinini, G., & Scarantino, A. (2011). Information processing, computation, and cognition. *Journal of Biological Physics*, 37, 1-38. DOI 10.1007/s10867-010-9195-3. (p. 19 and 21).)

Figure 17. Direct quotes incorporated in the text. Note the punctuation marks.

Quotes longer than 40 words are displayed as indented freestanding text. The citation appears at the end of the quote, outside the final punctuation mark (Figure 18).

What is paleontology? With this question, we point at paleontology as it has been understood since the modern synthesis of the theory of evolution, shaped between 1936 and 1947. One of the first answers within a broader theoretical framework was given by Schindewolf in his influential book *Grundfragen der Palaöontologie* (first published in 1950 and giving a comprehensive analysis about modern paleontology), posthumously translated into *Basic Questions of Paleontology*. He defined paleontology as follows:

Paleontology is the science of prehistoric life – of the fauna and flora of the geologic past. It is concerned with the systematics, mode of life, spatial distribution, temporal succession, and phylogenetic evolution of life forms that have been extinct and become fossilised – in short, of fossils. (Schindewolf 1993, p. 1)

The first goal of paleontology is ‘to collect specimens, to arrange them in a way that yields an overview, and to describe them’ (Schindewolf, 1993, p. 2). The ‘main field of research in paleontology’ is the ‘history of life’ (Schindewolf, 1993, p. 3), which is why paleontology is a ‘historical science’, which leads Schindewolf to the final conclusion that paleontology has a ‘very distinctive character among the natural sciences’ (Schindewolf, 1993, p. 4).

(Source: adapted from: Ebbinghausen, R., & Korn, D. (2013). Paleontology as a circumstantial evidence lawsuit. *Historical Biology*, 25(2), 283-295.
<http://dx.doi.org/10.1080/08912963.2012.688199>)

Figure 18. Indented direct quote longer than 40 words. Note the placement of the citation, outside the final punctuation mark.

4.3.3. *Placing the citation in the sentence or in parentheses*

As you will have noticed (see Figure 16 above), you have a choice between incorporating the citation *in the grammatical structure of the sentence* (“Sanders and Hessler (1969), Hessler and Sanders (1967) and Sanders (1968) adequately explained this paradox in relation to the time constancy of the deep sea, with its lack of physical perturbations by day and night, tides, storms, seasons or sea-level changes.”) or placing it *in parentheses* (“By way of ecological locks among constituent species, established communities provide, for a time, safe havens in an ever-changing world (Morris et al., 1995; Gould, 2002, p. 920).”). How do you decide to do this?

Consider the case where you have summarized in your own words the research that an author has done, and your text amounts to a whole paragraph. Do you place the citation in parentheses at the end of the paragraph? See Figure 19.

Not only will the worldwide temperatures increase, there is also an increase in sea level worldwide because of the melting of glaciers. Of course, sea level varies daily and monthly with tidal cycles; thus it is not easy to determine the “true” sea level. It is possible with techniques like geological studies of past levels of coastal terraces and beaches or satellite altimetry measurements. The following diagram shows the global average sea-level rise from 1900 to 2100. The dark shaded region is the average of seven climate models for all IPCC models. The light shaded regions show the range of other prognoses from other institutes (Hardy, 2003, p.133).

Figure 19. Example of a student paper (adapted) where the citation is placed at the end of the paragraph.

In the example in Figure 19, the reader does not know whether the source (Hardy, 2003) relates only to information reported in the last sentence or to more sentences or even to the whole paragraph. The reader's default position is to relate the citation only to the sentence that contains the parenthetical reference.

Note that you cannot place the parenthetical citation outside the final punctuation mark and then claim it refers to the whole paragraph. That is simply not correct.

There are three questions you can ask yourself in making a choice between citing within the grammatical structure of the text (or integral citation) or citing in parentheses (or non-integral citation).

Question	Answer
1. How much do you wish to cite?	One sentence or less, or more than one sentence.
2. If you are citing one sentence or less, how important is the name of the source?	<p>If it's the information that's important (not who said it), then you are more likely to use a non-integral citation (parentheses) (90% chance).</p> <p>If the name is important, then you are more likely to use integral citing (citation in the grammatical structure), and more likely to make the source (author) the subject of the sentence (10% chance).</p>
3. If you are citing more than one sentence, how great is the chance that the reader might misattribute the information (i.e. think it is your opinion only)?	<p>If the chance is higher, then you are more likely to use an integral citation, and more likely to make the source the subject (author) of the sentence (75% chance).</p> <p>If the chance is low, then you may use a non-integral citation (25% chance).</p>

Figure 20. Questions to decide about integral or non-integral citations. The approximate likelihood percentages have been derived from data in psychology, based on Wilkinson, Rijlaarsdam, and van Essen (2005). The percentages serve only as a guide. No analysis has been performed in other sciences.

Whether you paraphrase (saying in your own words) or quote an author directly, the source

should always be credited using either an integral citation or a non-integral one. Maastricht Science College requires that you apply the APA (American Psychological Association) standards for the citation of sources in so far as your work in the training is concerned. This chapter will discuss these standards, based on the *Publication Manual of the American Psychological Association* (American Psychological Association, 2010, 6th ed.). If you cite a source according to APA standards, you have to insert two components in the paper: a reference citation in the text (i.e., in-text citation) and a related entry in the references at the end of the paper. Section 4.4 discusses how to put a reference citation in the text in a correct way. Section 4.5 describes how to construct an entry in the references at the end of the paper.

4.4. In-text citations

If you cite a source according to APA standards, you have to insert two components in the paper: a citation in the text and a related entry in the references at the end of the paper. This section discusses how to put a citation in the text in a correct way. The APA standards for reference citations in the text use the author-year method. That is, the surname of the author and the year of publication are inserted in the text at the appropriate point:

<p>In a recent study of reaction times (Rogers, 2009)...</p> <p>Rogers (2009) compared reaction times... Rogers also found...</p>	<p>The standard parentheses (non-integral)</p> <p>When the name appears as part of the narrative (integral)</p> <p>Second mention within the same paragraph the year need not be included subsequently, if the name appears as part of the narrative. This only applies to integral citations in the same paragraph.</p> <p>For non-integral (parenthetical) citations, you have to give the name and year each time within the same paragraph.</p>
---	---

If you directly quote an author, in addition, the related page number has to be put between the parentheses, and the quoted text has to be put in double quotation marks.

<p>"Climate change is a vague concept" (Rogers, 2009, p.5).</p> <p>Rogers (2009, p.5) stated: "Climate change is a vague concept."</p> <p>Rogers also stated that "climate change is a vague concept" (p. 5).</p>	<p>The standard parentheses</p> <p>When the name appears as part of the narrative</p> <p>Second mention within a paragraph the year has not to be included subsequently, if the name appears as part of the narrative</p>
---	---

Often, for direct quotation at length, permission from the owner of the copyright is needed. This length varies from one copyright owner to another. If permission is requested and granted, a footnote should be made, acknowledging the permission (see section 5.2). Note that this footnote does not replace the related entry in the references, as discussed in the next section.

Now, both items author and date will be discussed into more detail.

4.4.1. One source by multiple authors

When a work has two authors, always cite both names every time (i.e. within the same paragraph and the subsequent paragraphs); in subsequent citations within the same first paragraph, exclude the year. In subsequent paragraphs, the first citation includes again the year; then within the same (subsequent) paragraph, the citation again excludes the year.

Rogers and Zoe (2008) found...	first citation in the text (integral citation)
Rogers and Zoe (2008) found...	subsequent first citation in any paragraph thereafter
Rogers and Zoe found...	second mention within the same paragraph, omit year from subsequent citations in same paragraph

When a work has three, four, or five authors, cite all authors and the year the first time the reference occurs; in subsequent citations within the same first paragraph, include only the surname of the first author followed by *et al.* In subsequent paragraphs, the first citation includes only the surname of the first author followed by *et al.* and the year; then within the same (subsequent) paragraph, the citation includes only the surname of the first author followed by *et al.* without mentioning the year.

Rogers, Tac, and Zoe (2005) found...	first citation in the text (integral)
Rogers <i>et al.</i> (2005) found...	subsequent first citation in any paragraph thereafter
Rogers <i>et al.</i> found...	second mention within the same paragraph, omit year from subsequent citations

When a work has six or more authors, always cite only the surname of the first author followed by *et al.* (i.e. within the same paragraph and the subsequent paragraphs); in subsequent citations within the same first paragraph, exclude the year. In subsequent paragraphs, the first citation includes again the year; then within the same (subsequent) paragraph, the citation again excludes the year.

Rogers et al. (2007) found...	first citation in the text (integral)
Rogers et al. (2007) found...	subsequent first citation in any paragraph thereafter
Rogers et al. found...	second mention within the same paragraph, omit year from subsequent citations

If a work has three authors or more, separate the different names with a comma including the last two, and join these names in narrative text (integral) by the word *and*. In a parenthesized citation in the text, the last two names have to be separated by an *ampersand sign* (= &).

Baaten, Jansen, and Noes (2008) found...	In narrative text, separate the last two names by <i>and</i>
In a recent market research (Baaten, Jansen, & Noes, 2008)	In a parenthesized reference citation in the text, separate the last two names by an ampersand sign

4.4.2. One source with no author

Sometimes the name of a group can serve as author (e.g., corporations, associations, government). This also applies to newspapers that do not identify the individual journalists, e.g. *The Economist*. This is called a group author.

In a telecommunications study (Vodafone, 2006)...

When a work has no author, cite in the text the first few words of the related reference entry (usually the title) and the year.

In an old report of the CIA (The Z-files of , 1967)...

When a work's author is designated as "Anonymous", cite the word Anonymous. Do not use this if the work has not been so designated.

In another report of the CIA (Anonymous, 1969)...

4.4.3. One source with no date

When a work has no date of publication, cite in the text the author's name, followed by a comma and n.d.

(Janssen & Schröder, n.d.)

4.4.4. Two or more sources

Distinguishing two or more sources from the same author

When you cite two sources from the same author with a different year of publication, there is no problem to distinguish them:

Baaten (2006) found...

Baaten (2009) found...

When you cite two sources from the same author with the same year of publication, lowercase letters are placed immediately after the year of publication, so that you can distinguish them:

Baaten (2009a) found...

Baaten (2009b) found...

The same principle applies to works with two or more authors in the same order. There is no problem to distinguish the works on first mention. However, if you shorten the reference citations with *et al.* on second mention (see above), then it would not be possible anymore to distinguish the works with multiple authors. In this case you must cite the surnames of the first authors and as many of the subsequent authors as are necessary to distinguish the two sources:

Baaten, Jansen et al. (2004) found...	second mention of Baaten, Jansen, Klaassen, and Zelt (2004)
Baaten, Jansen, Bank et al. (2004) found...	second mention of Baaten, Jansen, Bank, and Neus (2004)

When you cite two sources from different groups of authors that by coincidence all have the same surnames, then, in case of the same year of publication it would not be possible to distinguish them. You always have to include the first author's initials in the related reference citations.

R. Baaten, Jansen, and Noes (1994) found...

V. Baaten, Jansen, and Noes (1994) found...

Even in the case of a different year of publication it would not be possible to distinguish both sources in the right way. If you did not include the first author's initials in the related reference citations, then it would look as if they were two different sources from the same authors and not from different groups of authors.

4.3.5. *Personal communications and entire websites*

There are two types of sources that do not need a related entry in the references at the end of the paper: *personal communications* and an *entire website*. These two types just need a citation in the text.

Personal Communications

Personal communications include non-recoverable data. They may be for example electronic communications such as e-mails, non-archived bulletin boards, memos, interviews, private letters, telephone conversations, and conference speeches. In the related citation in the text, the initials as well as the surname of the communicator have to be provided, and the date has to be stated as exactly as possible, instead of only providing the year of communication.

(K. Hacker, personal communication, April 18, 2010)

K. Hacker (personal communication, April 18, 2010) said...

An entire website

An example of citing an entire website is the impression you got from visiting the homepage of the IBM firm. When you want to cite the related source, the citation in the text should only mention the web address (URL): *The homepage of IBM may be improved on several design aspects (www.ibm.com).*

However, usually you will not be citing a whole website, but electronic documents that you have downloaded, for example the Annual Report of the IBM firm. In this case, you have to insert the two components in the paper as mentioned at the end of subsection 4.3.3: an in-text citation and a related entry in the references at the end of the paper. Furthermore, apply all the same guidelines for printed sources, as described above. The only difference is the case of having no information about the year of publication. If the date of publication is not available, which is often the case when citing a document from the Internet, use the date of retrieval after the abbreviation n.d. For example, if you are citing a Project Report of IBM, which is available on the IBM website and IBM is the corporate author but no year of publication is given, then add the year of retrieval after a forward slash:

(IBM, n.d./2010)

Note that a firm's Annual Report will have a date of publication.

Table 2 summarizes the guidelines given in this subsection. For more detailed information, consult the APA Manual (2010).

Table 2. Basic citation styles

	Narrative or integral citation		Parenthetical (non-integral) citation	
Type of citation	First citation in text	Subsequent citations in text*	First citation in text	Subsequent citations in text
One work by one author	Galenson (2005)	Galenson (2005)	(Galenson, 2005)	(Galenson, 2005)
One work by two authors	Brandts and Charness (2004)	Brandts and Charness (2004)	(Brandts & Charness, 2004)	(Brandts & Charness, 2004)
One work by three, four, or five authors	Dejong, Forsythe, and Lundholm (1985)	Dejong et al. (1985)	(Dejong, Forsythe, & Lundholm, 1985)	(Dejong et al., 1985)
One work by six or more authors	Arrow et al. (2008)	Arrow et al. (2008)	(Arrow et al., 2008)	(Arrow et al., 2008)
Groups (readily identified through abbreviation) as authors	International Monetary Fund (IMF, 2009)	IMF (2009)	(International Monetary Fund [IMF], 2009)	(IMF, 2009)
Groups (no abbreviation) as authors	University of Edinburgh (2008)	University of Edinburgh (2008)	(University of Edinburgh, 2008)	(University of Edinburgh, 2008)

Adapted from *The Publication Manual of the American Psychological Association* (2010, 6th ed., p. 177).

* This applies to subsequent citations in subsequent paragraphs. See above for subsequent citation within the same paragraph.

4.5. The list of references

As stated several times before, if you cite a source according to APA standards, you have to insert two components in the paper: a citation in the text and a related entry in the references at the end of the paper (except for a personal communication or an *entire* website). This section describes how you have to construct an entry in the references at the end of the paper.

However, first the distinction between the *references* and a *bibliography* has to be explained, since these terms are often confused. A bibliography is more extensive than the references. The list of references contains only those works that are *actually* cited in the text. A bibliography, on the other hand, contains *in addition* all the works that have been consulted during the research, and that are considered relevant for further reading on the topic, but are not cited in the text. In most cases, at the MSC you will be required to construct a list of references. Only in the rare cases where your supervisor or instructor explicitly so requests you should you construct a bibliography.

The list of references begins on a new page. At the top of the page type the heading “References” (without the inverted commas) (or “Bibliography” if your supervisor has so requested). Note that, if you are numbering the sections in your paper, it is not the convention to give a number to the heading References, nor do you use any bullet points for each reference entry.

The following rules have to be applied in the construction of a reference entry:

A. Alphabetical order

The different entries should be arranged in alphabetical order by the surname of the first author. Each entry starts with a hanging indent and 1.5 line spacing between. Furthermore, each entry has to be aligned *left* (not justified). For the alphabetical order, the following rules have to be applied:

General

- Alphabetize letter by letter. Remember, however, “nothing” precedes “something”. For example: Brown, J. R. precedes Browning, A. R.
- Alphabetize the prefixes *M'*, *Mc* and *Mac* as if they were all spelled *Mac*.
- Alphabetize surnames that contain prefixes (*de*, *la*, *du*, *von*, *van* etc.) by starting with the surname: Akker, G. J. van de. (However, there are certain exceptions here: for example,

Van Gogh is always known as Van Gogh, not Gogh, van. Belgian names conventionally start with a capitalized Van.)

- Alphabetize entries with numerals as if the numerals were spelled out.

Order of several works by the same first author

- Single-author entries by the same author are arranged by the year of publication.
- Single-author entries precede multiple-author entries beginning with the same surname.
- Reference entries with the same first author and different second or third author are arranged alphabetically by the surname of the second author and so on.
- Reference entries with the same authors in the same order are arranged by the year of publication, the earliest first.
- Reference entries with the same author (or by the same two or more authors in the same order) and with the same publication date are arranged alphabetically, by the first significant word (i.e. excluding *A* or *The*) of the title that follows the date. Important: lowercase letters are placed immediately after the year of publication in the reference entry.

Order of several works by different first authors with the same surname

- Works by different authors with the same surname are arranged alphabetically by the first initial.

Order of works with no author

- If a group author can be used, alphabetize by the first significant word of the name. Spell out the full name of a group author. Do not use abbreviations. For example, *The National Institutes of Health* (2010) would be alphabetized under N.
- If, and only if, the work is signed “Anonymous”, then does the entry begin with the word Anonymous spelled out, and alphabetized as if anonymous were a true name.
- If there is no author, the title moves to the author’s position before the date of publication, and the entry is alphabetized by the first significant word of the title.

B. Categories of different types of sources

It is probable that most of the sources you consult for your papers will be available electronically, and you retrieve them from the University Library. You will probably retrieve different types of sources, such as journal articles (online), books (both hardcopy and electronic), and official reports. Under the Sixth edition of APA guidelines (2010) you are obliged to give the electronic source if that is where you retrieved the information, even if a hard copy is also available. Besides finding sources in the library, you may also retrieve information from other Internet sources, such as corporations or even TV or radio podcasts.

For each type of source you use in your academic papers you have to construct a different reference entry. Subsection 4.5.1. describes the general principles of the entries and subsection 4.5.2. presents examples of each entry type. Note carefully the order of elements in the entries and the specific punctuation used.

4.5.1. General principles governing elements of reference entries.

The APA referencing system follows a very consistent pattern, comprising the following elements:

Author element	Publication date	Title	Publication information	Electronic sources and locator information
----------------	------------------	-------	-------------------------	--

Author element

- Give the authors' surname and initials for up to and including seven authors². If eight authors or more, then list the first six followed by three ellipses ... and the last author. Use commas to separate each author, to separate authors and initials, and to separate initials and prefixes and suffixes.
- Use an ampersand (&) before the last author. Use period after each initial.
- Spell out the name of a group author in full. Put a period after the group author.
- Sometimes the publisher may be the author (e.g. *The National Institutes of Health*).
- In a reference with no author, move the title to the author position, before the date of publication. Put a period after the title. (This will be rare, as you can nearly always trace a group author or publisher.)
- In a reference to an edited book, place the editors' names in the author position, and insert the abbreviation *Ed.* or *Eds.* in parentheses after the last author's name. Put a period

² Note that the numbers of authors listed in an in-text citation is fewer than the number listed in a reference.

after the parenthetical abbreviation (*Eds.*). (Note: italics are only used for emphasis here; you should not italicize these abbreviations in the reference entry.)

- In a reference to a chapter in an edited book, invert the chapter authors' names and initials as above, but do not invert the editors' names and initials (see example below). Insert *In* before the editors' names.

Single author	Friedmann, M.
Three authors	Güreck, Ö., Irlenbusch, B., & Rockenbach, B.
Group author	World Health Organization.
Title when no author or publishing organization can be traced	Malaria vaccine imminent.
Edited book	Pandic, V. A., Hunter, G., & Pauwels, N. G. A. (Eds.).
Chapter in an edited book (see examples in subsection 4.5.2.).	Ruskin, S. (2009). Title of chapter. In V. A. Pandic, G. Hunter, & N. G. A. Pauwels (Eds.). Title of book.

Publication date element

- Give the date of publication in parentheses.
- For magazines, newsletters, and newspapers, give the year and the exact date of publication (month or month and day), separated by a comma and enclosed in parentheses. For papers or posters presented at meetings, give the year and month of the meeting, as above.
- Write *in press* for articles that have been accepted for publication but not yet published.
- If no date is available, write *n.d.* in parentheses.
- Close the element with a period after the parentheses.

Year of publication	(2009).
Publication date of newsletter or magazine	(2010, May).
Publication date of newspaper	(2010, September 3).
Article accepted for publication, but not yet published	(in press).
No publication date known	(n.d.).

Title element

- For an article or chapter title, capitalize the first word of the title and of the subtitle, if any, and any proper nouns. Do not italicize the title. Do not place quotation marks around the title. Close the element with a period.
- For the title of a periodical (journal, newsletter, magazine), give the periodical title in full³, in uppercase and lowercase letters. Italicize the name of the periodical. (See publication element below.)
- For the title of a non-periodical (book, report), capitalize the first word of the title and of the subtitle, if any, and any proper nouns. Italicize the title. Add any additional information for identification and retrieval (e.g. edition, report number, volume number) in parentheses immediately after the title. Do not put a period between the title and the parenthetical information. Do not italicize the parenthetical information.
- Close the element with a period.

Title of article	Application of a random resistor network model of space-time to various physical phenomena.
Title of journal	<i>Journal of Biological Physics.</i>
Title of book	<i>Mind as motion: Explorations in the dynamics of cognition.</i>
Title of report	<i>Nanofiltration shows promise in quest for pure water.</i> (CAS Chemistry Research Report).

Publication information element

For a periodical (journal, newsletters, magazines)

- Give the volume number after the periodical title. Italicize it. Do not use *Vol.* before the number.
- Add the issue number (if known, and need for identification) in parentheses immediately after the volume number. Do not italicize it.
- Give the inclusive page numbers of the cited material.
- Close with a period.

For non-periodicals (books and reports)

- Give the location (city and state in the USA, city and country if outside the USA)

³ You will notice that many science journals that do not follow APA style abbreviate the science journals according to a conventional procedure.

where the publisher is located (check on the title page of the cited document).

- Use a colon after the location.
- Give the name of the publisher in as brief a form as is intelligible. Omit superfluous words such as *Publishers, Co.,* and *Inc.* Retain words like *Books* and *Press*.
- If two or more publisher locations are given, give the location listed first or the publisher's home office.
- Finish the element with a period.

Periodical (journal)	<i>Computational and Theoretical Chemistry</i> , 1020, 7-13.
Publishers (books)	New York: Columbia University Press.

Electronic sources and locator information element

Electronic publishing is now the rule for much academic information. The general APA rule for citing electronic documentation is to use the same elements, in the same order, as for a fixed-media source, and add as much electronic retrieval information as is needed for others to locate the sources you cite. These include in particular uniform resource locators (URLs) and digital object identifiers (DOIs). Because electronic information can be moved, restructured or deleted, leading to broken hyperlinks and non-working URLs, scholarly publishers now assign DOIs to journal articles. A DOI is a unique alphanumeric string for articles. APA recommends that when DOIs are available, they are used for both print and electronic sources (see examples in section 3.4).

In most cases you will be able to locate the document you require through the University Library (via EBSCO or similar databases). However, if you know the DOI, you can locate the document via <http://www.doi.org/> It may occur that you do not always have access to the document without a subscription, but usually you will be able to get most documents through the library.

Publication data for electronic sources

- For electronic sources based on a print source (e.g. pdf), give inclusive page numbers for the article cited. Use pp. before the page numbers in references to newspapers.
- Give the DOI if one has been assigned to the content. Usually the DOI will be on the first page. Copy and paste the DOI, as it can be a long complex string.
- Give the DOI in the references as: doi:xxxxxxxxxx

- When a DOI is used, no further retrieval information is necessary.
- If no DOI is assigned, provide the URL of the document, journal, publisher. Make sure your hyphenation is turned off for this part of the referencing process.
- Do not insert a hyphen if you need to break a URL across lines; if necessary, break the URL before a punctuation marker. Do not add a period after the URL.
- Do not include retrieval dates unless the source material may change over time (e.g. Wikis).

DOI number	DOI: 10.1080/08912963.2012.688199
URL	http://www.cas.org/news/insights/chemistry-research-report

4.5.2. Examples of references

Table 3 gives examples of the different types of references. For cases not included in this table consult the APA Manual (2010).

Table 3. Examples of references

Periodicals		
1.	<p>Journal article with DOI</p> <p>Note: DOI appeared at the top of the first page</p> <p>Note: DOI appeared at the bottom of the first page. Note the DOI indicator also is prefaced by the retrieval site URL: http://dx.doi.org/</p>	<p>Piccinini, G., & Scarantino, A. (2011). Information processing, computation, and cognition. <i>Journal of Biological Physics</i>, 37,1-38. DOI 10.1007/s10867-010-9195-3</p> <p>Zhang, X. (2013). Methyl-to-double bond transfer in the gas phase: A theoretical study. <i>Computational and Theoretical Chemistry</i>, 1020, 7-13. http://dx.doi.org/10.1016/j.comptc.2013.07.015</p>
2.	<p>Journal article without DOI</p> <p>Note: The issue number is not strictly necessary as this journal is paginated by volume.</p> <p>As there is no DOI, give the URL if you retrieved it online. This may not be necessary if you retrieved it from the University Library's electronic journals.</p> <p>No retrieval date is necessary.</p>	<p>Cantor, J. (2012). Application of a random resistor network model of space-time to various physical phenomena. <i>Physics Essays</i>, 25(4), 484-487.</p>

3.	Journal article without DOI, title translated into English	Hasler, J., Penel, C., Gaspar, T., & Crèvecoeur, C. (2001). Mort cellulaire programmée, apoptose, ... et cellules végétales [Programmed cell death, apoptosis, ... and plant cells]. <i>Année Biologique</i> , 40, 75-95.
4.	Journal article without DOI, print version Note: This is a journal that you looked at the physical hard copy in the library. You did not retrieve it online. Even then, if the article has a DOI number you should cite it.	Ebbighausen, R., & Korn, D. (2013). Paleontology as a circumstantial evidence lawsuit. <i>Historical Biology: An International Journal of Paleobiology</i> , 25(2), 283-295, DOI: 10.1080/08912963.2012.688199
5.	Newspaper article Note: The publisher (<i>The Economist</i>) is the author in this case. There is no need to repeat the publisher. Give the exact date of publication. Note: newspaper sources are secondary sources and are dispreferred.	<i>The Economist</i> (2013, August 17). Birds of a feather land together. 62-64.
6.	Online newspaper article Note: The publisher's URL is sufficient in this case, as the exact date is already given.	Helmore, E. (2013, August 17). Is Voyager 1 really out of the solar system. <i>The Guardian</i> . Retrieved from http://www.guardian.co.uk/
7.	Special issue of a journal Note: Page numbers are not required as you are referring to the whole issue.	Varricchio, D., & Johnson, F.D. (Eds.). (2011). Fourth international symposium on dinosaur eggs and babies [Special Issue]. <i>Historical Biology</i> , 23(1).
Books, reference book, book chapters		
8.	Entire book, print version	Edelman, G.M. (1992). <i>Bright air, brilliant fire: On the matter of the mind</i> . New York: Basic Books. Gallistel, C.R., & King, A.P. (2008). <i>Memory and the computational brain: Why cognitive science will transform neuroscience</i> . Malden, UK: Wiley-Blackwell.

9.	<p>Entire book, electronic version</p> <p>Note: In this case, the entry concerns a classic work. It is not necessary to give all the original publication details.</p> <p>In this in-text citation use the following: (Darwin, 1859/2009).</p>	<p>Darwin, C. (2009). <i>On the origin of species by means of natural selection</i> [EBook #1228]. Retrieved from http://www.gutenberg.org/ebooks/1228 (Original work published in 1859)</p>
10.	<p>Book chapter, print version</p> <p>Note: The editors' initials appear before the surname.</p> <p>In case of two editors, no comma is used between two editors.</p>	<p>González-Férez, R., & Schweitzer, W. (1998). Atomic resonances in external fields. In A. Hernández-Laguna, J. Maruani, R. McWeeny, & S. Wilson (Eds.), <i>Quantum systems in chemistry and physics, Vol. 2: Advanced problems and complex systems</i> (pp. 17-25). New York, Boston, Dordrecht: Kluwer.</p>
11.	<p>Book chapter, electronic version</p>	<p>Darve, E. (2009). Thermodynamic integration using constrained and unconstrained dynamics. In Ch. Chipot & A. Pohorille (Eds.), <i>Free energy calculations: Theory and applications in chemistry and biology</i> (pp. 117-167). Berlin, Heidelberg, New York: Springer. Retrieved from http://mc.stanford.edu/cgi-bin/images/0/03/Darve_book_chapter.pdf</p>
Technical reports, annual reports, research reports		
12.	<p>Corporate author, government report</p> <p>Note: In this case the CAS service of the ACS does not give a location, either on the document or on its website.</p> <p>Note: The publisher is also the author, so the identification of the publisher in the publication element is not strictly necessary.</p> <p>Note: In the second report it is not strictly necessary to give the long URL, in case of a document that will not change.</p>	<p>American Chemical Society (2010). <i>Nanofiltration shows promise in quest for pure water</i>. (CAS Chemistry Research Report). Retrieved from https://www.cas.org/news/insights/chemistry-research-report</p> <p>Nuclear Energy Agency (OECD). (2003). <i>Radiological protection of the environment: Summary report of the issues</i>. Paris: OECD. Retrieved from http://www.oecd-ilibrary.org/</p>
13.	<p>Authored report</p>	<p>Diechmann, U. & Zhang, F. (2013). <i>Growing Green: The economic benefits of climate change</i>. Washington, DC: World Bank.</p>

Meetings, symposia		
14.	<p>Conference, symposium contribution</p> <p>Note: The title of the conference presentation is italicized.</p> <p>Follow the same principles for reporting lectures or similar academic contributions (see 15 and 16 below).</p>	Grossniklaus, Z. (2013, July). <i>Control of plant germline development</i> . Paper presented at 2013 Gordon Conference on Developmental Biology, Lucca, Italy.
15.	<p>Conference paper abstract retrieved online</p> <p>Note: The title of the paper is italicized.</p>	Kunze, K.E.. (2013, July). <i>Cosmological magnetic fields</i> . Paper presented at 40 th European Physical Society Conference on Plasma Physics, Espoo, Finland. Abstract retrieved from http://eps2013.aalto.fi/?page=SciProgram
Video or TV programmes		
16.	<p>Video or TV programme, video blog post</p> <p>Note: Radio and TV recordings are often archived or are available as podcasts. Video recordings may include blogs, as well as YouTube clips. Beware that they may not all be acceptable as academic sources.</p> <p>For referencing video recordings of lectures, follow the same principles.</p>	Taylor, L., and others. (2013, February 25). Mass spectrometry for biological research and network medicine applications [Video file]. YouTube: Mount Sinai Hospital. Retrieved from http://www.youtube.com/watch?v=5wgzful3F90

For more elaborate details and other types of references, see chapter 7 of *The Publication Manual of the APA* (2010, 6th ed., 193-224).

5. Manuscript presentation

This chapter considers the presentation of your paper. The format requirements for papers at Maastricht Science College are specified in section 5.1. The use of footnotes is treated in section 5.2., and the presentation of tables and figures in section 5.3. The chapter concludes with brief comments on revision of style, grammar and punctuation (section 5.4.).

5.1. Format requirements

Papers that you submit for assessment purposes at the MSC must be preceded by a cover page (sometimes referred to as 'documentation page').

Most papers that you submit to the MSC will comprise a number of pages of text divided into *sections* and *subsections*. Papers, articles, experimental reports, case studies, literature reviews do not have chapters.

A long assignment, such as a Master's thesis, which may contain 100 pages, however, may be divided into *chapters*, each of which will comprise several *sections* and *subsections*. For a doctoral dissertation, which may be 250 pages or more, you may decide to group several chapters together as *parts*, e.g. Part I: Theoretical framework; Part II: Findings from practice; Part III: Synergy and conclusions. Note that the requirements for such longer assignments may vary. Discuss this with your supervisor.

In addition to your manuscript text, you may add one or more appendices. These contain information that you do not want to put directly into the text of your paper, since otherwise they would interrupt the reader and distract from the line of the story. For example, detailed or extensive tables and figures may best be placed in an appendix. Mathematical proofs, extensive data output (e.g. an SPSS output), tables with information on biological samples used, and lengthy interview transcripts are further examples of information that is best put in appendices.

The following subsections deal with the format requirements of the paper.

5.1.1. Title page

Your manuscript will have two pages at the start: (1) the cover page, and (2) the title page. The **cover page** (or documentation page) is stipulated according to MSC requirements, and contains all the obligatory retrieval information for the College⁴. The **title page** of your paper is the first page of the actual text and should contain the following elements: the title (usually placed in the middle), your name as author (and your co-authors, if relevant) and ID number, and any further details that may be required. Further details may include an image, if appropriate. In some circumstances, other details may be required. In the case of a Master's thesis or a dissertation, you should check the specific requirements that may apply.

Do not mention any other information on the **cover page**. Items such as famous quotations usually do not belong to the **title page** either and but should be stated elsewhere in the paper, e.g. at the start of the first page of the text itself.

The title page should not be numbered. Numbering starts after the title page.

Ensure that the margins are wide enough to allow for binding.

5.1.2. The title

A paper must have a title, which gives the reader a clear indication of what the paper is about. It provides your readers with the first impression of your writing. A poor title puts your readers off: it may be too general or too vague, too emotional or too polemical, too chatty or too restricted. Make sure that it accurately reflects what you have written about. Relate your title to the nature of the paper: are you focusing on action or on facts? Titles that are focused on action typically start with a verb in the *-ing* form: *Taming tungsten in JET and ASDEX upgrade*. Titles that are focused on facts typically start with a noun: *Axial patterning and regeneration: old questions; new models*. Titles may also be direct or indirect questions, to which your paper gives an answer: *How do variant clones build an invariant retina?*. But, do not copy the complete thesis statement as the title. Finally, two-part statements are often used as titles, i.e. title plus subtitle: *How life begins: Identifying factors required for zygotic genome activation during maternal to zygotic transition*. Whichever form of title you choose, your paper has to reflect

⁴ The obligatory information on the cover page comprises: Name of tutor; Course code; Course Title; Course Coordinator; Tutorial Group Number; Student Name; Student ID number; Academic Year; Number of Words; Title Assignment; Pigeon Hole number.

accurately the topic established in the title. The title should be clear, not too long, and immediately understandable. Note that some science researchers (and some journals) prefer to summarize the main finding of their research in the title in a sentence: *Random network peristalsis in Physarum polycephalum organizes flows across an individual*.

5.1.3. Table of contents

In short papers a table of contents is not required. In papers longer than, say, 2000 words, it is desirable to insert a table of contents. You should also do this if the assignment requires a table of contents. Master's theses and dissertations do require a table of contents. See for example the table of contents at the beginning of this guide.

Conventionally, chapters, sections and subsections are indicated with Arabic numerals (1, 2, 3, etc.). Appendices are indicated by capital letters (A, B, C, etc.). If you are writing a dissertation and have grouped the chapters into parts, then indicate the parts by Roman numerals (I, II, III, etc.).

The table of contents should list all the headings at least as far as third-level headings. For most academic papers fourth-level headings are generally best avoided. However, in technical reports you may well find fourth- or even fifth-level headings.

Contents	
1.	Introduction 1426
2.	Direct desulfurization of fuel petroleum oils under microwave irradiation 1427
3.	Microwave assisted ODS of crude oil or its fractions. 1428
3.1.	Oxidizing agents for microwave assisted ODS of petroleum fuels 1428
3.2.	Oxidizing catalysts for microwave assisted ODS of petroleum fuels 1428
3.3.	Factors influencing microwave ODS efficiency of oils 1429
3.4.	Mechanism of microwave assisted ODS. 1430
4.	Other non-HDS techniques using microwaves for sulfur removal from oils. 1431
5.	Apparatus employed for microwave assisted desulfurization of oils 1431
6.	Conclusions 1432
	Acknowledgements 1432
	References 1432

Figure 21. Table of contents from a journal article: two-levels. Note most journals do not contain tables of contents for their individual article, although it is relatively common in applied mathematics and information science.

All pages must be *numbered*, except the documentation page and the title page (unless otherwise indicated). Page numbering is required to construct the table of contents, and it is also necessary for readers who may wish to refer to a particular statement in your paper, e.g. if they wish to quote from your Master's thesis.

5.1.4. Sections of a paper

The organization of your paper will depend on the genre you are writing. Thus, a literature review will have different sections compared with a paper reporting an experimental study. A critical analysis of an astrophysics theory will similarly have different sections compared with a case study. In all cases, number each of your sections, including the introduction. The introduction will, in almost all circumstances, be numbered 1.

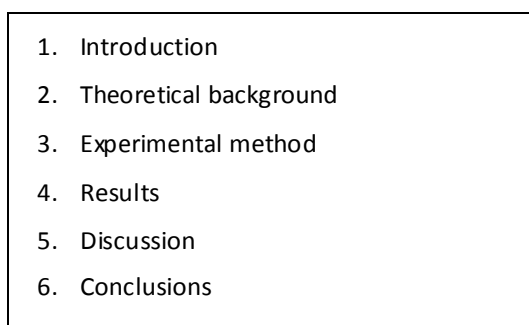
- 
1. Introduction
 2. Theoretical background
 3. Experimental method
 4. Results
 5. Discussion
 6. Conclusions

Figure 22. Example of principal section headings in an experimental paper. Note that some journals have the practice of printing the method section at the end of the paper, often in a smaller font. If you are submitting to a journal that requires this, then you may well have to adjust how you write your results section.

5.1.5. General format requirements

- Apply “1.5 line spacing” between all the lines, except for changing from section to section. In the latter case leave two blank lines, as shown in figure 23 below.
- Leave one blank line between a main section heading and the first paragraph. Do not leave a blank line between a subheading (second or third level) and the subsequent paragraph.
- Main (first-level) section headings in bold; second- or third-level subsection headings italicized. Ensure that a heading does not occur right at the bottom of a page: move it to the next page.

- Font: Times New Roman; font size: 12 points. Margins (top, bottom, left, right): 2.54 cm (= 1 inch). Paper size: A4 (210 x 297mm).
- Alignment: justified, using block paragraphs. This implies that *no indentation* of the first line is required for starting a new paragraph. Between two paragraphs there is a one-line (1.5) blank space.
- Do not justify the list of references. Align left, using a hanging indent.
- Choose one appropriate English spelling for the whole document. However, do not change the spelling of the title of a publication in the references if it uses a different English spelling.
- Enable “hyphenation”, to avoid large spaces between words, because of the justified alignment applied.
- Do not enable “hyphenation” for the list of references.
- In cases where a hardcopy has to be submitted, the paper should be bound before you hand it in.
- Note: special format requirements may apply to long texts, such as Master’s theses and dissertations. Check with the regulations that apply.

1.5 line spacing	1. Introduction
1 blank line (1.5)	Since the spread of the personal computer in the 1970s and 80s, the technology related to their material structure has been steadily advancing. This review focuses on the monitor displays and in particular the rise of the liquid crystal configurations currently in commercial use. While the Cathode Ray Tube (CRT) technology had dominated European and American electronics markets for the three decades, its popularity fell steeply in the new millennium. For example, a major electronics chain in the UK, Dixons, stopped selling CRT TVs in 2006, after sales had dropped from over 80%, to 20% and finally 5% in three successive years. (Times, 2006). The cause of this radical shift towards liquid crystal-based alternatives is twofold: Firstly, the CRT shortcomings, including particular toxic emissions associated with CRT televisions (Peters-Michaud, Katers, & Barry, 2010), and secondly the strengths of Liquid Crystal Displays (LCDs). With their low production cost, long lifetimes, and very thin display, they are suitable both for long-term purchases, such as televisions or personal computers, as well as smaller electronics, mobile phones or iDevices, which are likely to be replaced in less than two years.
1.5 line spacing	
2 blank lines (1.5)	
Section heading (bold)	2. Cathode Ray Tubes (CRT)
1 blank line (1.5)	
Subsection heading (italicized); no blank line afterwards	<i>2.1 Working principle</i>
1.5 line spacing	CRT operates by firing at a screen of phosphors, which give off light. The set-up consists of three main parts: An Electron Gun, an Electron Beam Deflector and a display screen. See Figure 3.1 for their relative positions.

Figure 23. Example of line spacing and layout. The font size of the text is reduced here purely for display purposes. Adapted from a student's paper.

5.2. Footnotes

The use of footnotes within the APA standards is not meant for a replacement of citations in the text and related reference entries. They are used in two ways: content footnotes and copyright permission footnotes.

Content footnotes

These kinds of footnotes supplement or amplify substantive information in the text. They should not include complicated, irrelevant, or non-essential information. A content footnote should convey just one idea. Since they are distracting to readers, these footnotes should only be used if they strengthen the discussion. In most cases, however, important information should be integrated in the text. An example of a content footnote:

In the text:

Finally, assumption 6 is that connectionist and classical theories of cognitive architecture are mutually exclusive.² By this assumption, we do not mean to rule out hybrid theories that combine symbolic and connectionist modules (cf. [59]).

Footnote:

²Classical theories are often referred to as “symbolic.” Roughly speaking, in the present context, a symbol is something that satisfies two conditions: (1) it is a representation and (2) it falls under a discrete (or digital) linguistic type. As we will argue below, conceptual clarity requires keeping these two aspects of symbols separate. Therefore, we will avoid the term “symbol” and its cognates.

Copyright permission footnotes

These footnotes acknowledge the source of long direct quotations in the text (see also subsections 4.3.2 and 4.4). For specific details, check in the *APA Publication Manual* (2010).

An example of a permission footnote from management (no example was found in the journals analysed in physics, biology, and chemistry):

¹ From: *On competition* (p. 100), by M. Porter, 1999, Boston: Harvard Business School Publishing. Copyright 1999 by Harvard Business School Publishing. Reprinted with permission.

Although the information in the footnote about the other source is quite elaborate, a complete citation in the text and a related entry in the references should be made. In general, it is unlikely that you will need to seek permission, since you are very unlikely to use long quotes;

that is a feature of textbooks, in particular. It is possible that you may do so in a Master's thesis or a dissertation. If so, you must seek permission to use the long quotation.

If you are reproducing a table, figure or other data display, then the acknowledgement (with permission, if granted) should appear immediately below the table or figure (see subsection 5.3.1.).

5.3. Tables and figures

For more information on APA style for tables and figures, see chapter 5 of *The APA Publication Manual* (2010). Here are some brief guidelines.

- Decide carefully whether you need tables and figures.
- Design the tables and figures so that your message is displayed effectively. Do not put in more information than you need to communicate your message.
- Do not use a large number of tables and figures in relation to the amount of text. It is easy for a reader to lose track when sorting through many displays.
- Label and caption your tables and figures appropriately and clearly. Consider carefully whether the reader will be able to understand.

When you are presenting your own tables or figures, you do not need to add yourself as the source, of course.

5.3.1. Tables, figures, and other exhibits from another source

Authors must obtain permission to reproduce or adapt all or part of a table, figure, or other exhibit from a copyrighted source. Although some owners of copyright give the permission to reproduce one table (or more), it is recommended to request always for permission. If permission is requested and granted, do not insert a permission footnote, as in case of a direct quotation in the text. Nor should a reference citation in the text be made. However, a complete reference entry must be included in the references. Instead of the permission footnote and the standard reference citation in the text, the following has to be applied. Any reproduced table, figure, or other exhibit must be accompanied by a note at the bottom of the reprinted table (or in the figure caption) giving credit to the original author and to the copyright holder.

Example of a reproduced table:

Table 4. The ODS efficiency of different metal phosphomolybdate.

Oxidizing catalysts	Oil type	ODS efficiency (%)
Phosphomolybdic acid [30]	BT	52.3
Oxovanadium phosphomolybdate [29]	BT	48.7
Cerium phosphomolybdate [41]	BT	61.1
Lanthanum phosphomolybdate [52]	BT	89.6

Note: (...). From “Development of microwave assisted oxidate desulfurization of petroleum oils: A review,” by H. Shang, H. Zhang, W. Du, & Z. Liu, 2013, *Journal of Industrial and Engineering Chemistry*, 19, p. 1429 (Table 2). Copyright 2013 by Elsevier B.V. Reprinted with permission.

In the place “(...)”any information can be put to clarify the table, like explanations and comments. If a permission was not requested, the last part of the note, “Reprinted with permission”, is omitted.

Example of a reproduced figure:

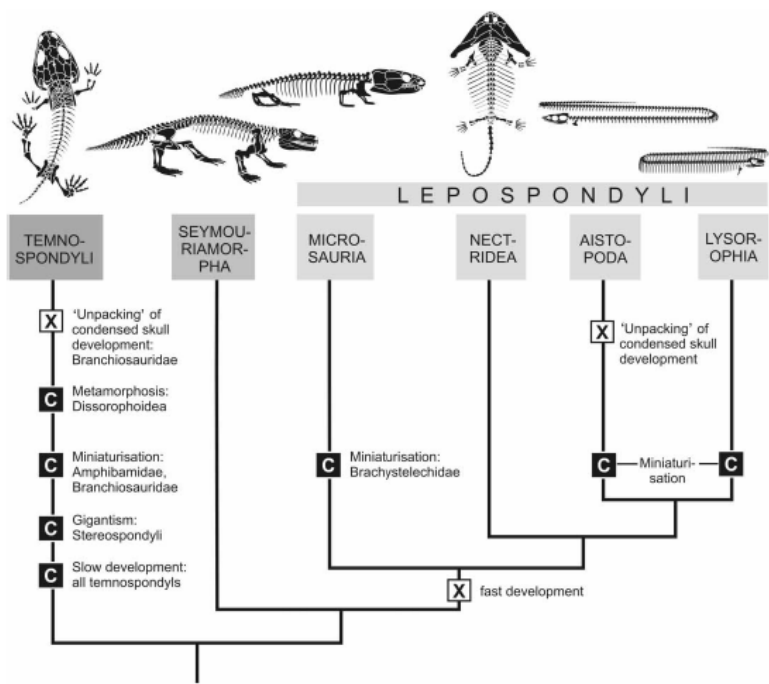


Figure 24. Synopsis of constraints (mapped as C in a black square) identified in early tetrapod phylogeny. Phylogenetic hypothesis based on Ruta et al. (2003). Broken constraints marked by an X in a white square.. (...) From: “How body size and development biased the direction of evolution in early amphibians,” by R.R. Schoch, 2013, *Historical Biology*, 25(2), p. 157. Copyright 2013 by Taylor & Francis. Reprinted with permission.

In contrast to a table, the figure caption is placed outside the figure. In addition, in some disciplines, all figure captions are collected in a separate part in the paper called *list of figures*. See example at the end of the Guide. Check if this is a requirement for you.

Again, in the place “(…)” any information can be put to clarify the figure, like explanations and comments. If a permission was not requested, the last part of the note, “Reprinted with permission”, is omitted. Usually permission is not required for internal assignments, but may be required for publicly available papers such as Master’s theses and dissertations.

In some cases where you use the table or figure from another source, you will need to adapt it so that it matches your purpose. This may mean you exclude information in the table or figure that does not relate to your topic. In most cases, you will have to redraw the figure. However, you still need to acknowledge the source, as above, but insert “*Adapted from*” instead of just “From”.

5.4. Revising the paper

Revision concerns everything that you do to create a text. Thus, it covers revision of your content, spelling, grammar, and punctuation. In this section we will focus on content; style and tone, grammar and punctuation.

5.4.1. Revising the content

Your first consideration when revising your paper is the content. You need to check if your paper correctly responds to the question or problem set, defined in the purpose or thesis statement. Check what you have written against the outline that you made during your planning, and check that your paper does match the purpose set.

Your purpose statement will have provided your paper with the controlling idea. Check that each section (and each subsection) in the body of the paper does expound and clarify the goal you have set yourself. If you find some information is not clearly relevant, then either delete it, or rewrite it in such a way that it is relevant. Consider the order of the points you make: do they occur in the most effective order for your topic, or should you reorder them? Check whether you have provided sufficient support for the points you wish to make. If you find that information is missing, that you have not provided adequate evidence, then add it.

One way of checking your work is to read the paper without the introduction; just read the middle part and conclusion. As you read, see if you can identify a clear pattern of organization of information: each point and each sub-point should logically fit into a pattern.

Next, you should check your conclusion. You must conclude by providing the succinct response to the purpose or thesis you set yourself. The conclusion needs to be based on the evidence or the arguments that you presented in the body. Do not have claims in the conclusion for which you have not provided any evidence before.

You also need to check the sources you have cited. Checking is not merely a question of correct citations in the text and the related references at the end of the paper; it concerns the accurate reporting of the information your sources have provided. Your aim should be to summarize or paraphrase the facts, ideas, and opinions that your sources advance: you are aiming to tell your story, after all, referring accurately to the sources of the facts and ideas.

Check that you have not plagiarized. If you have quoted a source directly, make sure that you have put the quotation in quotation marks, and that you have given the page reference for the quotation as well. Finally, check that all the sources you have cited in the text are accurately listed in the references. Your references should include only the sources cited in the text.

5.4.2. *Revising the style and tone*

The style of your paper should be appropriate to formal academic writing. Eliminate jargon that complicates your message. If you have used jargon or fashionable phrases (e.g. “an empowering environment”), ask yourself what it means. If you cannot explain it, you should not use it. The same applies to slang expressions, street language, and regionalisms (e.g. Britishisms and Americanisms that non-Brits and non-Americans do not readily understand). Specialist technical terms are not jargon if they are used in the appropriate context: they may, however, need a quick explanation. Check whether you need to do so.

Check that you have not filled your paper with unnecessary words (e.g. firms can be “bought” and “sold”, not “bought up” and “sold off”). You should cut all the unnecessary words. Writing in a short, precise style is a mark of good academic writing.

Style also implies using the active voice, rather than the passive. This strengthens your writing,

and makes it livelier. When you are revising, check every passive sentence to see if you really need it. In some circumstances, there are sound reasons for using the passive. Although the passive may seem to indicate an objective report of the facts or opinions, that is a myth: too many passive forms makes your writing dull and long.

Writing in an academic style also means writing clearly. Make sure that if you use abbreviations and technical jargon, you explain what they mean. Some very well-known abbreviations may be used without explanation (e.g. "DNA").

Academic style implies avoiding first-person pronouns (I, we, my, our, etc.). Cut out the first-person forms and rephrase the relevant sentences: this *may* mean switching to a passive structure or choosing different words. For multi-authored papers, "we" may be used. But it looks odd to use "we" if you are a single author.

Tone concerns the degree of commitment and emotion. Cut out needless repetition of "him or her" (making the sentence plural will often be a solution). Avoid emotional language (e.g. "the plan is stupid", "the organization is very bad"). Do not isolate your reader.

Avoid using contracted forms (e.g. "isn't", "aren't"). Do not try to be too smart: you are likely to irritate or bore your readers. Finally, do not try to teach your readers: cut out as many imperatives as you can (e.g. "Recall that ...", "Remember ...", "Consider ...", "Note ...").

5.4.3. *Revising the grammar, spelling and punctuation*

This guide does not include a section on grammar. At entry to the MSC you are expected to have good English and thus to have mastered the basic principles of good sentence structure and coherent paragraph writing. If you have specific problems, consult a grammar book.

Your first check is at the level of the paragraph. You check whether each paragraph is well structured, whether there is a topic sentence, and whether the paragraph is adequately developed. If you are comparing, for example, does your paragraph compare? If you are explaining the causes of a situation, does your paragraph give the causes? Then you look at the pattern of nouns and verbs to see if they are consistent. In other words, make sure that you do not mix up different kinds of sentence structure. For example, the more frequently you change the subject of sentences, the

more difficult the text is to read. Similarly, if you change frequently from active to passive verb tenses, you make it more difficult for your readers to understand. Consistent chains of subject within a paragraph ensure that your paper is easier to read.

Secondly, check the connective words and phrases to see whether they support your argument. Connective words function at two levels; at a rhetorical level between paragraphs and between sentences, and within sentences, as links between clauses and phrases. Some connective words will function at both levels, but most will not.

You need to check too whether you are using the appropriate connective word, for example:

Words for addition	in addition, moreover, for example, for instance, in particular, and, also, both ... and, as well as
Words for cause	thus, consequently, as a result, so, therefore, as a consequence, thus
Words for contrast	but, however, although
Words for sequence	briefly, first, finally, next, then, in short, second, third

Check whether you have used too many connective words or not enough: how well does your argument hang together? Can your readers follow, or do they have to infer too much between points? Are you patronizing your readers by using too many connectives? The message risks becoming obscured by the means.

At the level of each sentence, you need to check the nouns, the verbs, the pronouns, and the syntactic structures. Check that your sentences are not ambiguous or unclear. Especially check that you can clearly identify what every pronoun, especially “it”, “this”, and “that” refers to. Use a grammar checker if available, but they are not infallible.

Similarly, use the spell checker carefully before you submit your paper. However, spell checkers are not perfect, so double-check in a good dictionary if you are in doubt. Papers with careless spelling errors usually attract lower grades. Whether you choose British or American English, be consistent throughout your paper.

There are numerous websites that will help you with grammar. We only mention one here: Purdue University’s Online Writing Lab: <http://owl.english.purdue.edu/owl/section/1/5/>

Finally, double check all your punctuation. For example, there are differences in punctuation practices between English and many European languages, such as the use of the comma. Check by using a good guide. Many are available electronically.

5.5. Evaluation

As stated before, it is not possible to give a blueprint for the writing of a paper. The same applies to the assessment of a paper. Every paper is tailor-made and needs to be considered as such. However, the assessor refers to a defined set of criteria when correcting your paper. All these criteria are discussed in the preceding text in this guide. The criteria may vary slightly from assignment to assignment. However, the list below indicates the four categories that are typically taken into account, with selected subcomponents.

Content

- The title is effective.
- Literature and sources are correctly and sufficiently applied.
- The assignment is correctly and sufficiently elaborated.

Structure

- Sufficient background information is given to introduce the topic.
- The introduction contains a purpose statement that presents clearly what the paper is about and addresses the main issue.
- The paper has a clear outline.
- The paper is coherent: it has a clear structure and development, and focuses on the main issues.
- The paper does not contain irrelevant matter.
- The conclusion follows logically from arguments developed in the matter and answers the purpose statement.
- The paragraphs are well structured.

Accuracy

- Grammar is sufficiently accurate.
- Terminology, vocabulary and expressions are accurate and appropriate.
- Spelling is sufficiently accurate.
- Punctuation is sufficiently accurate.
- Style and tone is appropriate to formal academic and scientific writing.

Format and citing

- The paper is presented correctly (documentation page, title page, headings, block paragraphs, line spacing, etc).
- Tables and figures are presented correctly.
- Citations in the text are correct and complete.
- References are correct and complete.

Additional criteria may be applied from time to time.

References

- American Psychological Association. (2010). *The publication manual of the American Psychological Association* (6th ed.). Washington, DC: Author.
- Bruer, J. T. (1993). *Schools for thought: a science of learning in the classroom*. Boston: MIT Press.
- Fulwiler, T., & Hayakawa, A. R. (2000). *The Blair Handbook* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.
- Hannay, M., & Mackenzie, J. L. (2002). *Effective writing in English* (2nd ed.). Groningen, Netherlands: Martinus Nijhoff.
- Jordan, R. R. (1997). *English for academic purposes*. Cambridge: Cambridge University Press.
- Wilkinson, R., Rijlaarsdam, G., & van Essen, A. (2005). Patterns of citation behaviour in published psychology articles. In L. Allal & J. Dolz (Eds.). *Proceedings Writing2004* [(pp. 141-147) CD]. Geneva: Adcom Productions & University of Geneva.

List of Tables and Figures

Tables

Table 1. Types of papers and associated purpose statements.	20
Table 2. Basic citation styles.	51
Table 3. Examples of references	58
Table 4. The ODS efficiency of different metal phosphomolybdate.	70

Figures

Figure 1. Stages of the writing process.	8
Figure 2: The writing process and its recursive nature.	9
Figure 3. Six steps in the planning process.	13
Figure 4. Examples of outlines.	14
Figure 5. Example of an introduction from a journal article (review paper).	19
Figure 6. Example of an outline paragraph in a scientific paper.	23
Figure 7. Example of a conclusion section from a science paper.	28
Figure 8. Sample paragraph illustrating the topic sentence, the elaboration sentences, and the closure.	30
Figure 9. Spatial elaboration (partial).	31
Figure 10. Temporal elaboration.	32
Figure 11. Analytical elaboration.	33
Figure 12. Deductive elaboration.	34
Figure 13. Inductive elaboration.	34
Figure 14. Dialectical elaboration.	35
Figure 15. Enumerational elaboration.	36
Figure 16. Example of appropriate citation of sources.	37
Figure 17. Direct quotes incorporated in the text.	42
Figure 18. Indented direct quote longer than 40 words.	43
Figure 19. Example of a student paper (adapted) where the citation is placed at the end of the paragraph.	43
Figure 20. Questions to decide about integral or non-integral citations.	44

Figure 21. Extract from table of contents from a journal: two-levels.	64
Figure 22. Example of principle section headings in an experimental paper.	65
Figure 23. Example of line spacing and layout.	67
Figure 24. Synopsis of constraints.	70

About the author

Robert Wilkinson, MSc, works at Maastricht University Language Centre, focusing in course and materials design. He has been working for the School of Business and Economics and other faculties since the mid-1980s, designing and implementing courses in writing and communications skills for English-medium programmes. His particular interests lie in the integration of content and language in the process of academic learning, especially in writing. In this regard, he has organized the first three international congresses specifically devoted to such integration, all of which have been hosted at Maastricht University. His professional experience includes work in several other universities, as well as in business, government, and academia, both in the Netherlands and widely abroad.