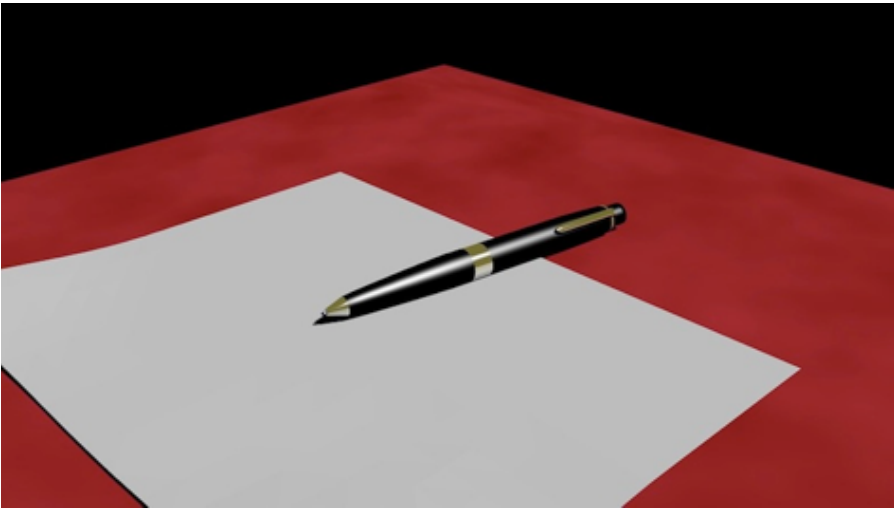


Expository Scientific Writing

A Short Guide

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About the author



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Ken Cheng is the author of two other books, *How Animals Think and Feel* (2016, ABC-CLIO, Santa Barbara, CA, USA) and *Biological Basis of Behaviour* (e-textbook, 2018, Top Hat, Toronto, <https://tophat.com/>). He has also composed a number of songs and verse.

The current book arose from Cheng's experience in helping scholars individually in academic writing, scholars ranging from first-year university students to postdoctoral fellows.

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Chapter 1 Classic style

Writing is a strange business. It is like talking, but the audience is not there, and words flow not in spoken form but as text on paper, or more commonly now, on screen. The writer often does not even have any audience in mind as she writes, preoccupied as she is with putting words on screen. (Following Pinker (2014), I am casting the writer as “she” and the reader as “he” in this chapter, with the roles reversing in each subsequent chapter.) For those who learned English as a second, or third or fourth language, and for whom English is not their dominant language, putting sentences on screen may be a struggle, such that the sentence construction may jostle for mental bandwidth and crowd out the bigger picture of writing. This little book is a brief attempt to alleviate some of that struggle.

A part of reducing struggles in writing comes from a patchwork of tips on the construction of sentences and especially parts of sentences, or phrases. But this guide must begin with a philosophy of writing aesthetics, the discussion of style. I am not speaking of a set of detailed rules here regarding a piece of writing, the kind exemplified by guides to authors published—online these days—by journals, concerning the length of the abstract allowed, reference style, section headings, how to report statistics, and the like, matters that we can call nitty-gritties. Rather, style is an overarching philosophy of writing, an aesthetic stance. According to Thomas and Turner (1994), style is always there in writing, like the typeface in which text is set. Different stances on the fundamental elements of writing make different styles. The style that suits expository scientific writing fittingly is classic style (Thomas and Turner 1994; Pinker 2014).

Classic style

The basic stance of classic style is that the writer is presenting the truth to the reader. Presenting the truth is like leading the reader to a view to see. Seeing serves as an operative metaphor for classic style. The writer has done the hard yards, that is, the research and the sorting out of ideas from her

research, and come to a view. Now her task is to share that view with the reader, who has not done the hard yards. The stance that she takes is that were the reader to have completed the background work that she has, he would come to just this view. The writer's job is to present to the reader a window to the truth.

In other stances representing other styles, the writer might wax contemplative about what she is writing, or indulge fully in her own subjective reactions. These are legitimate styles of writing, but they are not classic style. Classic style is a play presenting a narrative of the truth.

The stance of classic style is that truth can be known, and thus truth can be presented. Truth about something provides the motive for writing. This again is an aesthetic stance rather than a philosophical stance. Philosophically, it is difficult to defend the position that a single objective truth governs everything in the world, and that science goes after that truth. The classic stylist assumes a stance of presenting the truth for clear and comprehensible presentation. She writes to lead the reader on a logically formed journey to a view of the truth. Again, this truth is the view that she the writer has come to after scaling her mountain of research.

In classic writing, the writer takes the reader on a tour of some truth, and does the tour-guiding in a conversational manner, as if she were talking to a competent and interested reader. In Jill Brown's (2016, <http://wordsbyjillbrown.com/what-is-classic-style/>, accessed January 2019) summary, the scene is informal, the idiom is conversational, not heightened or rhetorical. And the stance that both the writer and the reader are competent is another fundamental tenet of classic style. All this means that the classic writer minimises the use of jargon and technicalia, and explains matters using ordinary language. When jargon is used, it is first explained to the competent reader. To the classic writer, language can be used to explain everything, from molecular biology to philosophy. Classic writing is not a struggle to get ideas across. At its best, it should seem effortless

to the reader, even though the writer has expended meticulous effort in crafting her prose.

A few maxims of classic style

The philosophy of classic style provides the basis for some maxims about writing, although none of these guidelines stand firm as absolute rules. The goal of such maxims is contained in Thomas and Turner's (1994) title, *Clear and simple as the truth: to present discourse clearly and simply for ready comprehension*.

One maxim has already appeared, and that is to use a minimum of technical jargon. Some technical terms may well be necessary for scientific discourse. The writing may be about sexual selection, quasars, or peptides, all terms on the technical side. The dictum is not to overuse technicalia, and certainly not to flaunt jargon so as to impress readers with a misguided sense of scholarship. Rather, getting the reader to see some piece of truth is the goal of classic style, done in the manner of an intelligent conversation.

A second maxim is not to qualify and obfuscate endlessly. A whole cast of *it might be the case that, possibly, seems to*, and their ilk detracts from the exposition. Once again, some qualification may well be necessary for the objective of truth, as many matters in science remain uncertain. One strategy is to admit the uncertainty up front, and then get on with the story. For example, when describing the writer's interpretation of some results, she might admit first: the best interpretation that comes to mind invokes X. With X, ... the writing could then proceed without a crowd of *perhaps* and *seem*.

Third, watch out for nominalisations, as they deaden the writing. This ugly word means turning verbs into nouns, such as turning *confirm* into *confirmation*. Nominalisations can turn lively verbs into zombie words (Pinker 2014). Thus, "confirmation of Z's theory came from our results" zombies the action of confirming, exemplified by the straight claim, "our results confirm Z's theory".

Finally, conversations are direct, and as a result, the classic style writer avoids long empty introductions to sentences and paragraphs. “For a long time, researchers have been interested in ...” strings out many words without getting to the substance of the sentence. Or, “it just might be the case that ...” floats around not conveying the important message. The legendary boxer Muhammad Ali was famous for a pair of phrases, which he applied to his boxing: “float like a butterfly, sting like a bee”. In classic writing, stick to the second half of Ali’s dictum. Get in there to deliver the punchline of the story, cutting out the floating. Or to phrase it the way author Philip Pullman does, read like a butterfly, write like a bee.

Paragraphs

A basic tenet of organising paragraphs is the dictum one paragraph, one theme. If classic style is a guided journey, then one paragraph takes the reader to on a trip to one place, for one view. The guide, the writer, makes clear to the reader where the voyage is headed to, rather than meandering on a mystery tour that suddenly ends in a view. Thus, within a sentence or occasionally two, the reader knows where the paragraph is heading. A paragraph of one sentence that announces a trip but goes nowhere falls short, renegeing on a promised tour. A paragraph that wanders across three or four locations (themes) along the way packs too much into one tour. Such a paragraph is hard for readers to make out, and being clear to readers is a fundamental stance of classic style.

What this means is that for many writers, paragraph planning before launching into words flowing on screen helps, akin to having an itinerary of locations to visit. Typically, the first sentence announces the theme of the paragraph to come. The rest of the paragraph is then a logically organised sequence of sentences expounding that theme. Occasionally, it might take two sentences to set up a theme. Some themes might need two sentences to announce, and sometimes, the first sentence serves as a bridge between the theme of the previous paragraph and the

theme of the current paragraph, for example: 1) While *X* shows ..., *Y* on the other hand ... 2) The key characteristic of *Y* ...

The end of the paragraph might recapitulate the theme, or it might not. Endless repetition of the original theme announcement, even in different wording, can be tiresome. But key new insights not in the introduction to the paragraph may serve well in a concluding sentence. Another service that the last sentence can provide is to foreshadow a new theme—for the next paragraph—preparing the transport arrangements for the next leg of the itinerary.

For many writing projects, especially for the constraints and demands for conciseness of modern-day journals, itinerary planning could save the writer from repetition and disorganised wandering in her writing. Itinerary planning helps the flow of a section as well, as consideration of the overarching journey lets the writer structure the order for her destinations and the best routes to navigate between destinations.

Sentences

A sentence, like its bigger sister the paragraph, has its own dictum: one sentence, one idea. A sentence that jams many different ideas together becomes hard for the reader to process, or else strays into the grammatical no-no region of a run-on sentence, considered grammatically wrong as well as inelegant in style. Here are some concocted examples of sentences jamming too many ideas together:

1) History may be able to explain this with the rise of labour-saving machines humans spent less time doing household chores such as preparing food, washing, making beds, and cleaning, therefore they turned to other pursuits.

2) C and B did not write about particular methods, rather they stressed the need for integration, this could help clinical practice.

Each of these sentences stuffs three different ideas together into the jumble of a single sentence in run-on fashion. In 1) one idea

tells of an explanation invoking history, while a second idea details some consequences of labour-saving devices, and a third idea claims a consequence concerning human behaviour. The lot is easier to parse in three separate sentences. 2) packs together what was not written, what was written, and some consequence of what was written, in a clumsy fashion. The reader of this current book might practice rewriting these passages into two or three sentences.

Again paralleling the paragraph, in formal scientific writing, a sentence should take a step and go somewhere, that is, proclaim something rather than simply express a sentiment. One does not have occasions to trumpet satisfaction or bemoan a catastrophe with expressions such as “hurray for gravitational waves” or “too bad for the birds living in trees”. An exception to this injunction is made for writing tertiary literature. Tertiary literature comprises pieces meant for a popular audience, from newspaper articles to magazines for the public to encyclopedia entries to blogs. For tertiary literature, exclamations in small doses without factual content could spice up the writing.

Keeping the stance of a conversation in mind, the classic writer would take care not to make a sentence too long and complicated and thus difficult for her reader to parse and understand. Protracted, convoluted sentences can always be disbanded into smaller friendlier chunks. Here is a concocted labyrinthine mess:

Because intersexual selection relies on female choice, and not on male choice, this because females usually have much more at stake in choosing a sexual partner since it costs them much more to produce an egg, and sometimes to take care of the fertilised egg after copulation as well, compared with males, female animals have driven the course of the evolution of animals.

Such monsters stoke irritation and metaphorical headaches in readers. They are best restrung as several separate sentences

building up to the interesting idea that the choices of female animals have driven the course of evolution.

A sentence in a scientific article is not a play, but both theatre and science writing should convey drama. For a sentence, the general rule is to put the drama at the end, much like the climax in a play. Which of the following expressions pack the most drama?

- 1) The production of antibiotics took off after the discovery of penicillin.
- 2) After the discovery of penicillin, the production of antibiotics took off.

At the sentence level, a reminder of an earlier stated maxim is to minimise fluff, those empty lead-in phrases and qualifications that float like a butterfly not saying anything of substance. Especially at the start of a paragraph and at the start of a section, packing a punch or stinging like a bee draws the reader on. Some contrived examples smacking of being formal but delaying the delivery of content are:

- 1) Among the interesting concepts in the study of addiction in recent decades is ...
- 2) Whereas some scientists might disagree with such a point of view, it just might be the case that it would be fairer to say that ...

When Richard Dawkins (2000) writes “We're going to die, and that makes us the lucky ones”, a bee sting of a punch is thrown.

As a final feature on sentence writing, use strong words. Feeble phrases such as *there is* or *is involved in* can usually be rephrased by more colourful language. Thus, instead of writing:

Antimicrobial proteins are involved in initialisations of chemical reactions.

a stronger alternative is to ditch the nominalisation and promote an active verb:

Antimicrobial proteins initialise chemical reactions.

Livelier language engages readers better.

References

- Dawkins, Richard. 2000. *Unweaving the rainbow: Science, delusion and the appetite for wonder*. Boston, New York: Houghton Mifflin Harcourt.
- Pinker, Steven. 2014. *The sense of style*. London: Penguin Random House.
- Thomas, Francis-Noël, and Mark Turner. 1994. *Clear and simple as the truth: Writing classic prose*. Princeton: Princeton University Press.

Chapter 2 Structuring a scientific paper

Even though a scientific paper is a well defined piece of writing, the rules leave much room for individuality. The rules announced on journals' instructions to authors specify mostly nitty-gritties, such as titles of section headings, length of abstracts, and the number of keywords. A few tips on the organisation of the entire work help budding writers in writing a journal article, in crafting both an empirical paper reporting newly amassed data and a scholarly review of an area of study.

Empirical paper

An empirical paper forms part of what is called the primary literature, reporting a body of results for the first time in print or, more and more often these days, online. Some of the results might have already been reported at some conference as a poster or talk, explaining the necessity of adding the qualifying phrase after "first time". The empirical paper in all branches of science is delineated into four main components: introduction, methods, results, and discussion. To these main courses are added necessary embellishments such as an abstract, key words, acknowledgements (increasingly detailed in these days of transparency and often divided into different components such as information on funding and declaration concerning conflict of interest), and, importantly, references. These accessories differ from journal to journal, with the instructions to authors usually specifying them. Even the arrangement of the main components, however, may vary across journals.

The most notable variation in arrangement concerns papers with multiple experiments. Some journals specify a single methods section before any results appear, with the methods of Experiments 1, 2, and 3 described first before any of their results. Others prefer to have experiments as the first division. Thus, the methods and results of Experiment 1 come first, then Experiment 2, then Experiment 3. Each Experiment might have a tiny introductory segment preceding it. Some journals even allow or encourage a brief discussion of the results of each experiment.

Even this arrangement, however, has an introduction to the entire paper in the beginning and a discussion, sometimes called *General Discussion*, at the end. With both of these major styles, some general tips about each section can help.

Introduction

The introduction sets up the empirical work, tells the reader why the work is important, and guides the reader to the gist of what to expect by way of the experiments or observations to come. Good rules of thumb are to address four key questions.

- 1) Why is the research significant?
- 2) What do we know?
- 3) What do we not know?
- 4) What does the study contribute?

In the terse introduction sections of some journals that are tight on space, each of these questions might form the theme of the single paragraph, in the order of the numbered questions.

At the very start, the writer would typically explain the importance of the topic of research, zeroing in from a general field of research (photonics, pliable materials, evolution of dinosaurs) to the particular research theme of the research (improving lasers, using metals in making pliable material, mobility in velociraptors). Questions 2) and 3) form a coordinated pair. The writer sketches what is already known in order to highlight a gap in that body of knowledge. He (the writer now taking the male pronoun in this chapter) then explains how the research to be presented fills some gap in the area of study. The introduction might end with the gist of the methods used in the study, to be detailed in the next, methods section. Such a gist typically bridges the introduction and methods sections well.

Methods

In the methods section, the implicit rule is to describe everything that is needed for another person to repeat the study. It is easy for the writer to miss something about the methods that his reader would want to know. The writer knows about his or his team's work intimately, and this curse of knowledge (Pinker

2014) could make him overlook details that are obvious to him but not to his readers.

Equipment is described in the Methods, and a rule of thumb is that specialist equipment should be described and explained, with the brand name given, while everyday equipment just needs to be named. A tape measure or a test tube does not need to have its brand proclaimed, but a photospectrometer should be named, and its operation should be described. What counts as everyday equipment does vary from field to field. A rule is when in doubt, describe the apparatus.

Judgement is needed as well in deciding how much procedural detail to delineate. If a procedural nuance makes a difference to the experiment or the observations (in non-experimental studies), it needs to be described. An animal might have to be placed into the apparatus on its back, with its head pointing towards Or, y ml of distilled water might have to be added to the mixture at a rate of x ml per second. If the default that a reader would assume is fine, then details can be skipped: We added y ml of distilled water ... ; or, the rat was placed in the start box. The writer could assume common sense in a reader wanting to replicate the work, that she (the reader replicating the work) would not add water from a contaminated test tube, and would not throw the rat into the start box with all her strength. When in doubt, however, err on describing too much detail.

The style of writing methods sections has seen changes over the years; in particular, the dictum to always write in the passive voice has loosened. Some journals now in fact prescribe the opposite: the writer should always use the active voice. The decree of always active, however, does not translate to the best style. The rule produces many and tiresome repetitions of the word *we*: We tested 90 wombats. We divided them at random into 4 groups. We kept the wombats in ... We fed the animals every day with ... All these *we* words taking up prime real estate are not even the key information bearers. What really matter are the wombats, being divided into 4 groups, being kept in certain

conditions, etc. Always writing methods in the active voice could turn out as wooden as always presenting the passive voice. One way out, if the journal allows it, is to mix passive and active voices. But even with the “always active” rule, the writer could reword to focus the story on the experiment taking place rather than the experimenters.

In this strategy, the focus is placed on the events and agents in the experiment rather than on the experimenters, all in the active voice. Thus:

We tested the wombats in a special test arena. The arena consisted of ... We placed the wombats in the start box, and arranged the following sequence of events. The door of the start box opened. When the tested wombat exited, x appeared on the left monitor while y appeared on the right monitor ...

Or:

The following mixture went into the test tube containing b ml distilled water: x , y , z . A centrifuge (brand name) homogenised the contents.

Thus, even the straight forward but rigorous methods section could be infused with some conversational flavour.

Results

The results section lends itself readily to classic style. The writer is leading his readers through a tour of selected findings. The findings are selected because not everything noted in the study is necessarily reported, these being scientific rather than stylistic decisions. Two rules of thumb help to organise the results section.

The first adage is to start with the most important results, not necessarily following the order in which the variables were described in the methods section. Other results, especially by way of qualifications, control checks, and nuances, could come later. An exception to this adage is that if a preliminary control check can be quickly dealt with, that could be presented first. This could be something like: We pooled the results from the

three replicates because they did not differ significantly (Figure *x*). The reader is most curious about the key results, and the writer should satisfy that curiosity before fudges, qualifications, and extras are presented.

The second adage is to describe the pattern of results first, in everyday language, before launching into any formal statistical treatments. Launching straight into the statistical treatment makes readers do extra cognitive work to figure out what the results actually say. For example, consider starting with “An analysis of variance on variable *y* showed significant main effects of factor *a* (stats) and factor *b* (stats), but not of factor *c* (stats). The analysis of variance also found no significant two-way interactions (stats).” Such a technical coverage demands cognitive processing for the reader to figure out the pattern of results. Moreover, this passage remains vague. A main effect tells of some difference, but not the direction or nature of the difference. The results are better illuminated with a description at the start:

Group Experimental generated much higher scores than Group Control on variable *y*, while with an increase of factor *b*, scores decreased (Figure *x*). Factor *c*, on the other hand, did not influence the results. An analysis of variance confirmed these impressions ...

Such a formulation announces the story before the messy, formal, but necessary statistical backing unrolls.

Data summary devices, figures and tables, make huge contributions to a results section. When presented well, they aid the reader’s comprehension immensely, and also liven up what might be a technical slog through the formal thickets in the words of the section. A general rule is that figures are preferred over tables. Figures hit the reader immediately; at their best, they dramatise a story at a glance. Tables require the reader to work to construct a pattern out of the numbers and labels making up its rows and columns.

An effective figure discloses a rich story without overburdening the reader. Added details, such as a line showing chance performance level or the measure from another key study, could enrich a figure, but too much clutter leads scientists to decry the figure “too busy”. Space should be used effectively to make labels big enough to be readily intelligible at a glance. Tiny numbers on axes with chasms of white between them disadvantage readers with poor eyesight—and we are in an age of inclusiveness. Gratuitous use of colour is to be avoided on similar grounds: it could impair comprehensibility for colourblind people. To present three types of bars, for example, three scales of grey differentiate the bars effectively, and are to be preferred over three different hues whose greyscale levels may be confusable. Where the use of colour really helps to enhance a graph, the colours should be chosen to be friendly to the colourblind. Search the Internet for tips on this imperative of inclusiveness.

Tables are not to be denigrated, as they play a key reserve role on the presentation team, jumping into the fray when a figure cannot score the goal of clear presentation. This goal may be blocked when too many numbers need to be summarised. A figure depicting 12 conditions across 10 points of time, replete with error bars showing the variation around each point of data, would not deliver a story at a glance to the beleaguered reader. It might look so messy that any component of it requires attentive visual tracing of a line, amidst the background clutter of 11 other lines, for the struggling reader to grasp the pattern of one condition. That lot needs to be tabulated. The numbers make a small army, but at least each condition would be neatly arrayed across one row.

Tables could play another reserve role in relieving the text of the results section, by capturing a mass of formal statistics. If a statistical analysis is substantial, a table saves a heap of F 's, d 's, p 's, and perhaps effect sizes from blanketing the Results. The story of the results flows more smoothly, with only occasional reference to Table x needed.

These data-summarising devices forge a results section, and writers may structure the section around these star players. One figure might rally one or sometimes two paragraphs around it, with the contents of a well designed figure evoking sensible themes for paragraphs. Writers may find this section easier to write with the display elements in hand.

Discussion

The Discussion section accords the writer the most freedom to roam, but it is not a free-for-all. The section should start off discussing and interpreting the data reported, and for some papers and some journals, that would be all. After the data have been discussed, then broader topics may be broached. A good rule of thumb for this further roaming is to start with topics close to the data and branch out to big-picture ideas. As psychological science tells us that the very end of a series of events is often remembered better than the middle events (under the rubric of the recency effect), the writer might branch out to something big in the last paragraph, and end with something memorable to his readers.

At the other end of the section, the very start of the Discussion might highlight the results. This is helpful if a prodigious platoon of data have marched across the results section. Like the commentary at the end of a broadcast of a ball game, key highlights are recounted, not a blow-by-blow chronological depiction of all events starting with the first motion of the ball. The retell-all strategy is likely to garner groans of repetitiveness from reviewers, editors, and readers alike. If the Discussion focuses on three patterns in the results, a sensible highlights package is to recount just those patterns.

Other than these brief hints, the guidelines of classic style will serve the Discussion writer well. This section is the least straight forward of all the major chunks of an empirical paper; it demands the most creativity from the writer, both in content and style. But hopefully, the section is also the most interesting to write.

Review paper

In comparison with an empirical paper, a review paper allows the writer more scope, but also demands more creativity and craftsmanship. The purview of a review is unlimited, but space often is. A few journals do not set limits on review articles, but most standard journals featuring a mix of empirical and review papers frown upon voluminous reviews, while others set strict limits. As a result, reviews vary in size. The size-limited reviews must focus on a narrow topic, while more expansive reviews may roam widely. While not formally structured into sections like empirical papers, review papers have three recognisable chunks: an introduction, a review, and some discussion.

A few tips on the all important introduction are worth chronicling. A review needs a *raison d'être* beyond the writer's having read a pile of literature and perhaps having made notes on them. A postgraduate student typically has such a task of rummaging through an opus on a topic to come up with ideas for research. That is not enough for a review, and such a compilation makes a dry plate of hard-to-digest food for thought. The review needs a purpose; the writer needs to convince his readers that his review is timely. Perhaps his review trumpets a new idea never before seen in this pile of literature. Perhaps the last comprehensive survey was 20 years ago. Perhaps different ideas or ideas from different subdisciplines are juxtaposed in his review. Perhaps the writer is parading a new method of analysis. Perhaps the writer has found a new angle to look at the known corpus of results, and proffers fresh windows to the truth. Perhaps the writer is rallying the field to action. The writer might harbour a combination of such *raisons d'être*. Whatever they are, the writer should traipse beyond the claim that they have to read this literature for doing a thesis or a research project.

The introduction should also carve out its terrain. Does it attempt to be comprehensive, perhaps following some search strategy that might even appear in a methods section? Does it select studies on one set of grounds or another? Does it only

focus on studies that meet certain criteria, in order to put a magnifying lens on particular gems of results? Space limits often impel the writer to fence his turf, and giving reasons for his choices guides the reader to the review to come. These reasons should include why some terrains have been excluded from his review.

Steven Pinker (2014) warns against the overuse of metadiscourse—those proclamations that tell the reader the topics on deck—but at the end of an introductory segment of a review, a road map for the reader sets her up comfortably for the journey to come. The overarching aims of the review are typically also announced here. Here are some examples.

Despite their taxonomic disparity, co-evolution with brood parasites exposes social insects and avian parents to convergent selective pressures. It is therefore interesting to examine just how much these two systems have in common with each other. The aim of this review is to address two broad questions, which have not been considered in previous comparisons of avian and insect brood parasites. The first question asks how the co-evolutionary arms race proceeds. Do certain sorts of host defences predictably select certain sorts of counter-adaptations in the parasite, for example, and therefore do we see the same types of host defences and parasite counter-adaptations in both the birds and the insects? The second question addresses the outcome of co-evolution. Are there predictable endpoints, common to both insects and birds, and are some arms races more likely to favour victory for the parasite rather than the host (or *vice versa*)? Although we draw on diverse studies from both insects and birds to answer these questions, here we have not attempted an exhaustive survey of the vast literature on co-evolution in each taxonomic system. Our focus instead is on common concepts. We apologise at the outset to the many researchers whose work we

were unable to include in this review simply for reasons of brevity. (Kilner and Langmore 2011)

In this contribution, we present a new systematic geochemical and sulfur isotope characterization of syngenetic and epigenetic sulfide mineral generations of the Cuiabá deposit. The classification of pyrite, pyrrhotite and arsenopyrite types is based on textural variations and defined paragenetic stages. We suggest that the various pyrite stages document the isotopic and geochemical evolution of the mineralizing fluid. Data obtained by electron probe micro analyzer (EPMA) and LA-ICP-MS illustrate element incorporation in the pyrite varieties hosted in metamorphosed carbonaceous pelite, BIF and mafic volcanic rocks. Our aim is to understand the traceability of the mineralization history from textures and sulfide trace element content and sulfur isotope signatures in the different host rocks. Pyrrhotite and arsenopyrite data serve as indicators to constrain the consistency of element distribution throughout the sulfide minerals. In general, multiple sulfur isotope analyses (^{32}S , ^{33}S , ^{34}S , ^{36}S) of pyrite and pyrrhotite related to gold mineralization confine the origin of sulfur to felsic magmas, mantle-sourced, metamorphic or meteoric fluids, as well as sedimentary source. As the transport of Au in hydrothermal fluids is generally assumed to be complexed with HS⁻ in orogenic gold systems ... tracing the sulfur source may place strong constraints on the origin of Au. (Kresse et al. 2018)

In the first part of the paper, we review the institutional aspects and recent industry trends related to SRI [socially responsible investments]. ... Second, we address a fundamental question at the heart of SRI: should a firm's aim be the maximization of shareholder or stakeholder value? ...

Third, we study whether SRI investors care less about financial performance than conventional investors by discussing the empirical evidence on the risk and return characteristics of SRI. ...

Fourth, we discuss whether the investment behavior of SRI investors is different from that of conventional investors by reviewing the recent literature on the money-flows into and out of SRI funds. ...

Fifth, we review the theories and evidence on whether the emergence of SRI impacts on the real economy. ...

The main conclusion of this survey is that while some research has been performed on SRI, there are still a great many issues and puzzles that require further study. (Renneboog et al. 2008)

In the case of Renneboog et al. (2008), the authors expended one paragraph to describe each section to come, and then added a summary paragraph at the end of the introduction containing an overview of all the sections to come.

The body of the review then must contain the sections announced in the introduction. The writer could use the chunks named in the introduction as section headings to organise his writing, whether or not he eventually includes such headings in the final product.

The body of the review comes in different degrees of depth of description. At the detailed level, one study would command one paragraph, with its main methods, results, and conclusions trotting through the paragraph. At the compact level, one study might be sketched in just one sentence, perhaps featuring only its most important result. Multiple studies showing a similar pattern of results might even be packed together in one sentence. The level of detail depends on a number of factors, including the word limit of the review and the importance of the study. Central studies to a theme might demand an entire paragraph even when space is limited. No hard and fast rules can be given for writing

the body, but the tenets of classic style aid the writer in presenting the guts of the review clearly.

One point to add about the body is that it need not be purely descriptive. In a review, the writer has the freedom to add comments to the description. In fact, such comments usually make the piece more interesting to his readers. Criticisms of problematic methodology, sketches of limitations, or praise for clever experimentation all make fodder for comments along the way. Major comments about an entire corpus of studies, on the other hand, are better saved for the discussion to come after the body. The decision hinges on whether it makes better sense for a comment to wait until all the pieces are displayed on the table. It is typically comments about particular studies that could be sprinkled in the body.

A review should present more than a list of A found this while B found that, the stuff that makes up the body. It should be rounded off with the writer making sense of the scholarly work that he has presented, in the form of a discussion, often labelled explicitly as "Discussion". This makes the piece more than a list of "here is what I read and took notes on". Within the broad confines of respectable academic writing, anything can go into a discussion, from noting patterns in the data to modelling some of the data to a new theory to major criticisms. The writer needs to construct a discussion carefully and thoughtfully. This part is sometimes what sells the piece, to editors and reviewers commenting on the piece, and later, to readers considering citing the piece. The writer should do more than summarise the pattern of results and say that more research on the topic would be good.

References

- Kilner, Rebecca M., and Naomi E. Langmore. 2011. Cuckoos versus hosts in insects and birds: adaptations, counter-adaptations and outcomes. *Biological Reviews* 86 (4): 836-852.
- Kresse, Carolin, Lydia M. Lobato, Steffen G. Hagemann, and Rosaline C. Figueiredo e Silva. 2018. Sulfur isotope and metal variations in sulfides in the BIF-hosted orogenic Cuiabá gold deposit, Brazil: Implications for the hydrothermal fluid evolution. *Ore Geology Reviews* 98:1-27.
- Pinker, Steven. 2014. *The sense of style*. London: Penguin Random House.
- Renneboog, Luc, Jenke Ter Horst, and Chendi Zhang. 2008. Socially responsible investments: Institutional aspects, performance, and investor behavior. *Journal of Banking & Finance* 32 (9):1723-1742.

Chapter 3 Nitty-gritties of avoiding foibles, especially for those for whom English is a foreign language

Chapter 1 provided some broad-brush strokes on what to do in writing. This chapter paints some scattered dots on errors in writing. The lot comes from my own experiences at helping early-career writers in scientific writing, from undergraduate students to postgraduate students to some postdocs. The mix will have a flavour of a pot pourri.

Sentences

The problem of run-on sentences has reared its head in Chapter 1. This treacherous murderer of style deserves more alarm calls. A run-on sentence is considered ungrammatical by those who write about style. A run-on sentence strings together what should be separate sentences into one sentence. Such a conglomeration is usually hard for readers to parse, and strikes them as unpleasant to read. Here are more concocted examples.

- 1) An addiction originates from the way the brain responds to a stimulus, or stimuli, the stimuli trigger a response in the brain, it creates a reward for the user, increasing mood.
- 2) Evolution may be able to explain this phenomenon with the advent of civilisation humans took to farming, making permanent settlements they were preoccupied with chores for living.

Multiple sentences have been strung together, making it hard for readers to separate out the ideas. Run-on sentences need to be broken apart into separate sentences to be readable and grammatical. In 2), ideas making sentences are: evolution forming an explanation, activities of humans with the advent of civilisation, and humans' preoccupation with chores. Three separate sentences would make the passage flow in a comprehensible fashion. Thus, embellished and polished, the passage could become:

The recent evolutionary history of humans plays a role in explaining the phenomenon of addiction. At the advent of civilisation, humans became busy with farming and building permanent settlements. These activities for day-to-day life soaked up their time, leaving little spare time for unessential pursuits such as the use of addictive substances.

Whether the ideas expressed in the passage are correct is quite another matter.

A particularly ugly run-on revolves around the word *however*. This problem crops up enough times to warrant its own alarm call. Some writers, mistakenly, use it as a connective (formally called conjunctive) between different sentences, as a substitute for the likes of *and*, *but*, and *although*. The result, however, makes an ugly, ungrammatical run-on sentence. Here is a concocted example:

I would like to kick the rear end of anyone who does this, however I would get in serious trouble doing this.*

The * indicates an ungrammatical sentence. The proper way to write the passage is to break it into two sentences, with *however* serving to add emphasis and drama to the second:

I would like to kick the rear end of anyone who does this. I would, however, get in serious trouble doing this.

Strunk and White's classic book (1979) recommends not putting *however* at the beginning of a sentence. One way to think of the placement of *however* is to treat it as a drum roll before some dramatic announcement, such as getting into trouble. Because a sentence takes some words to get to the drama, *however* usually has most effect somewhere in the middle of a sentence. At the start of the sentence—where it is still grammatical to place *however*—the drama is too far off. An at the end of the sentence—where placing *however* is again grammatical—the drama is over. Such a rule, as usual, is not hard; sometimes, a sentence becomes too clunky to have *however* in its middle, and the word

may go better at the front. At other occasions, it could go at the very end to fan the flames of drama.

Scientific writing is mostly in the past tense. The experiments have already been done, or the observations have already been made, by the time authors write up their study. And indeed, in writing about the events that have already taken place, the writer should put matters in past tense. Present tense, however, is used for some occasions. Two common kinds of occasions are a) proclamations of general truths, and 2) describing parts in the paper, such as a figure. Under 1), general conclusions drawn from a study may be put in present tense, as is accepted knowledge from past endeavours. Thus, Einstein's theory of general relativity claims that Or, Darwin's theory of sexual selection predicts Under 2), the writer usually refers to contents in a figure or table in the paper in the present tense. Figure 1 shows that Or, the data in Table 1 reveal

Of course, the future tense is also appropriate on the right occasions. This tense is propitious when, what else, talking about future events, such as the course of research. Thus, a typical ending to a paper might plea that more research taking a certain tack will help with some worthy scientific enterprise.

An opposite foible to run-on sentences are sentence fragments. These ungrammatical errors fail to make a whole sentence typically because the subject of the sentence is missing. Here are some concocted examples.

- 1) Thus suggesting that this hypothesis is wrong.*
- 2) Showing that this author is a poor writer.*
- 3) Such as a species' phenotypic adaptability and its epigenetic program.*

All these sentence fragments have lost their head, or subject. It is unclear in 1) what shows the hypothesis to be wrong, even though the writer is probably implying whatever was the subject of the previous sentence, such as "the results of the study". It is not clear in 3) what sorts of entities phenotypic adaptability and the epigenetic program are supposed to be, although again, the

writer is probably implying the subject described in the previous sentence, such as “possible explanations of this type of behaviour”. Sentence fragments can feel like afterthoughts that should have been tacked onto the previous sentence. Informal conversation might be dotted with such fragments, often precisely as afterthoughts that pop up. But in writing, the writer is expected to have thought and planned her sentences, and not toss in afterthoughts that would strike readers as ungrammatical.

Two ways to fix sentence fragments are a) to add a sentential subject, and b) to tack the fragment onto the previous sentence. Take the first example about the wrong hypothesis. Applying solution a) to 1), the sentence could become:

Thus, the results suggest that this hypothesis is wrong.

Applying solution 2), the sentence might become:

Our results did not conform with predictions based on W’s round-about hypothesis, thus suggesting that this hypothesis is wrong.

Parts of sentences

From consulting budding science writers, parts of sentences that go astray include the use of articles or other accompaniment for nouns, the use of pronouns, and some punctuation marks (in a separate section), including various stripes of a horizontal line (-, -, —). Writers need to pay close attention to these matters, whose infiltration will sour readers’ impressions of the piece.

In English, when a noun phrase walks onto a page, an article or some other accompaniment is often required as a chaperone. Common chaperones are: *a* and *the* (grammatically, articles), *this*, *that*, and *these* (demonstratives), *some* (quantifier). Nouns come in two broad varieties, proper nouns and common nouns. Proper nouns are names of particular individual entities, abstract or concrete, such as *Marie Curie* (name of a person) or *International Geology Review* (name of a journal). In most cases, proper nouns do not appear with articles, demonstratives, or quantifiers, but a few exceptions should be pointed out. Proper

nouns that are contain plural nouns or are composed of complex phrases need the word *the* to accompany them, such as *the Choir of Hard Knocks*, which meets both criteria. Some geographical entities also come with *the*, such as rivers and seas, but not lakes: *the Missouri*, *the Mediterranean Sea*, but *Lake Ontario*. The unadorned word *Missouri* refers to the State of Missouri, not the river. Common nouns comprise the bulk of nouns, the rest of the garden-variety nouns such as *woman*, *scientist*, and *journal*. With common nouns, the writer must think about accompaniment.

A good strategy is to think of common nouns as small children that require a guardian in public, although sometimes, that guardian appears disguised as a blank, indicated as square brackets around a blank in Table 3.1. Rules differ for countable vs. uncountable or mass nouns, so that we must first grapple with this grammatical distinction. A countable noun can be singular or plural, and the writer can attach a number to such a noun, for example, *one apple* or *three apples*. An uncountable or mass noun is conceived as a mass entity that cannot be counted, grammatically anyway, including words such as *water*, *justice*, or *rice*. The categorisation into countable vs. uncountable is grammatical rather than physical. The reader can physically count grains of rice, but the noun *rice* remains uncountable grammatically. Uncountable nouns cannot be grammatically plural; one cannot write *two waters** or *two rices**.

Table 3.1. Some common accompaniment that may be used with different kinds of nouns.

noun countability	how many	definite or not	suitable accompaniment
countable	singular	definite	the, this, that
countable	singular	indefinite	a, one
countable	plural	definite	the, these, those
countable	plural	indefinite	some, []
uncountable	singular	definite	the, that, this
uncountable	singular	indefinite	some, []

In each of the cases of countable and uncountable nouns, the grammatical distinction regarding the accompaniment hinges on whether the noun is definite or indefinite. For a definite noun, its identity has been established previously, while for an indefinite noun, its identity is unknown although a noun announces the kind of entity that it is, for instance, a woman or a journal. The indefinite noun is some such entity, one or some of that kind of entity. Definite nouns take on a suite of ‘definite’ guardians, most commonly: *the, that, this*, or in plural: *the, these, those* (Table 3.1). Indefinite nouns take on a suite of ‘indefinite’ guardians, for countable nouns, most commonly: *a, one* for the singular case. Note from Table 3.1 that an indefinite uncountable noun (always in the singular) takes on the suite of accompaniment that plural indefinite countable nouns do. This class of nouns splits their allegiance between being singular and plural. The verbs that they take on are singular: “water tastes good after a long tennis match”, whereas the accompaniment that escort them smacks of the plural: “Qi brought some water to drink at the beach”. This brief passage hopefully suffices for all writers tackling nouns and their accompaniment in English.

Pronouns, common ones used in science such as *it* and *they*, spawn another source of common writing errors. The errors in using pronouns usually do not violate grammar, but cause problems because their (the pronouns’) identity may be cloaked. A pronoun serves as a shorthand for some already identified noun phrase, but it must be clear to the reader which already described noun phrase the pronoun is referring to, or else ambiguity makes for difficult reading. The following modified passage illustrates such an ambiguity—I changed an original passage by Diano (2018) into poor writing:

The discovery of leptin and its action on the central melanocortin system confirmed earlier predictions of a crucial role of peptides produced by neurons in this system, neuropeptide Y and proopiomelanocortin. Further studies of *them* revealed an important role in the control of feeding.

The word *them*, placed in italics to indicate its problematic nature, comes with a number of possible identities. Does it refer to neurons, to peptides, to predictions, to some combination of leptin and its action on a system, or some combination thereof? In such instances, the writer must use a noun phrase to clear up the identity assignment. A phrase such as “circuits in this system” in place of “them” leaves no doubt as to which entity the writer is indicating. To prevent the tedium of repeating the same noun phrase over again, the writer could use variations in naming an entity, as the phrase “circuits in this system” illustrates. Pronouns make more concise writing, and journals preach conciseness these days. But it is never worthwhile buying conciseness at the expense of clarity.

Words

Pinker (2014, ch. 6) gives advice on a host of words, getting to be a purist on a number of them. His collection is extensive and the advice sophisticated. I will discuss briefly just three sets of words that a writer should get right to avoid grating on her readers.

Affect and *effect*. These are different words, each with multiple meanings. A literate reader would cringe at their misuse, and it behooves the writer to use these words correctly. Both words serve in the roles of verbs and nouns. *Affect* in its noun role, with the stress on the first syllable, means emotion or feeling. *Affect* in its verb role, with the stress on the second syllable, has two different senses. In one sense, it means to influence, as in: “Alcohol affected his judgement.” In a second sense, it means to fake or put on airs, as in: “She affected a sophisticated air to impress her professor.” *Effect* as a noun means something akin to consequence, or, in a statistical sense, the outcome of some statistical comparison. *Effect* can also be used as a verb, meaning to carry out. In this sense, it can be used in a Methods section, as in: “We effected the following measures to purify our sample.”

Irregardless. This non-word is a mixture of *irrespective* and *regardless*, and is still considered wrong and cringe-worthy. Use *irrespective* or *regardless*. Words forged by a mixture of two other words are called portmanteau words. *Portmanteau* itself is borrowed directly from French, in which the word means a large travelling bag. Lewis Carroll made a now well-known portmanteau in *Jabberwocky* with the word *chortle* (“He chortled in his joy”), a mixture of *chuckle* and *snort*. To me, portmanteaus are most colourful and useful when they mix words with sufficiently different senses—such as *chortle*—but combinations of words having similar meanings have also made it onto the world stage, such as the word *ginormous*, a combination of *giant* and *enormous*, now a popular portmanteau word rising in use. I have learned one from my own daughter: *confuzzled*, which combines *confused* and *puzzled*, a state all too often experienced by students. This word is still frowned upon in some circles, but every language, like every species, is an evolving entity, and I suspect that it will make its way into dictionaries in time.

Lie and lay. Two lines in the folk song *Blue-Tail Fly* go:

Beneath his stone I’m forced to lie*

A victim of the blue-tail fly.

Well, the lines rhyme, but I have put an asterisk at the misuse of the word *lie*. It should be *lay*, which would wreck the rhyme. This pair of verbs are confusing because the past tense of *lie*, in the sense of resting in a horizontal position and not in the sense of speaking false statements, is *lay* (and its past participle is *lain*). The verb *lie* is intransitive; it cannot take an object. Grammatically, you can lie on a bed of roses, but you cannot lie a fly under a stone. On the other hand, the verb *lay*, meaning to put something somewhere, is transitive; it has to have an object. Its past tense, and past participle, is *laid*. Thus:

I was forced to lay a specimen of a blue-tail fly under the tombstone of my master, who died from being thrown from his horse after the equine mammal was bitten by a member of that particular dipteran species.

Punctuation: dashes and the comma

The three symbols consisting of horizontal lines merit a brief passage because some writers toss them in haphazardly. The shortest of the lot is the hyphen, -; a middle-length horizontal line serves as the en dash and also as the minus sign, –; the longest one is the em dash, —. The en dash and the em dash are not found on many keyboards; laptops typically do not flaunt them. In the common writing software *Word*, they can be found with the command to insert advanced symbols, in the pile called “(normal text)”. Some writers toss the hyphen in to serve for all three punctuation marks because it sits on the keyboard. While misuse of these horizontal-line symbols will not damn a paper to rejection, a stylish writer might as well use them correctly, and hopefully in the process use them to good effect.

The hyphen is a joiner of words that usually stand apart. Thus, *a long-deceased cat* means that the cat died long ago. The adjectives *long* and *deceased* make a team in describing *cat*. In this instance, the write might be able to get away without the hyphen, and write just *long deceased cat*, but that could foment ambiguity. Compare that hyphenated phrase with a phrase describing a cat as *a long, deceased cat*; this latter phrase with a comma separating the adjectives means that the cat is long and the cat is deceased, but *long* and *deceased* describe the cat separately rather than together. (More on this when we come to the comma.) In other instances, words need to be hyphenated together to make a team serving as an adjective describing some noun phrase, such as *event-related potentials*, *long-range missiles*, *time-lapse photography*. Note that when it comes to the hyphen in *a long-deceased cat*, writing is more explicit than speech in marking a difference. In speech, *long-deceased cat* and *long, deceased cat* have the same pronunciation. A difference is marked, however, in the cadence of speech, with a pause between *long* and *deceased* in the latter case, a pause marked in text by the comma.

It is incorrect to use the hyphen, -, to mark a span, for instance a span of time: *1965-1969** (the asterisk once again

indicating an incorrect phrase). This role falls to the en dash, –: 1965–1969. A span in space should also be marked by an en dash, such as a *Sydney–LA flight* or *3–7 m distance*. Note that the en dash should not appear after a phrase introduced by words such as *from* and *between*. Thus:

She published 20 papers from 1965–1969*.

The sentence should be:

She published 20 papers from 1965 to 1969.

The em dash plays as a super sub, often excellent at injecting drama into the writing. In different roles, the em dash can substitute for the colon, the comma, and the parentheses (brackets). The em dash sets off a phrase or whole sentence and gives it more excitement and salience. Here is an example from one of my books:

Others—such as rats, mice, and flies of the genus *Drosophila*—have become mainstays of laboratories ... (Cheng 2016, p. 1).

The em dashes could have been replaced by commas or brackets—both cases would have been grammatically fine—but the animal species named stand out more with the em dashes enclosing them. The em dash can also play as a singleton, in which case the rest of the sentence follows the announcement made by the em dash that something else is on the way. To use an example from my book again:

Lamarck thought that evolution was directed—directed to higher, more complex, more ideal forms. (Cheng 2016, p. 3)

Again in this case, a comma could have been used. But I preferred the drama conferred by the em dash. Sometimes in such end-of-sentence cases, a colon could be substituted. A colon might serve better if the sentence leads the reader to expect something, such as a list of items, to follow. Another example from the same page illustrates this use:

The theory of natural selection can be summarized in three principles or “ingredients”: heritability, variation, and selection. (Cheng 2016, p.3)

The sentence announces three ingredients, and the colon indicates that they are about to be delivered. In sentences in which it is not clear that some items to follow are announced, the versatile em dash plays the role better. This was the case for the sentence starting with *Lamarck*. It was not clear that anything is to be expected after the first *directed*.

The budding writer might splash out on some em dashes to spice up her writing. The em dash is often left on the sidelines because other punctuation marks may substitute for it, the lot of parentheses, commas, and colons. In most cases, parentheses and commas play less dramatically than does the em dash. Like a delicate spice, the em dash should not be overused. But the writer might carefully consider when one of her phrases can be set off with the flourish of the em dash.

Many punctuation errors are minor in nature and can be cleaned up readily by copy editors. Yet some, especially those revolving around the comma, can significantly alter the meaning of a sentence, and others are so glaringly bad as to be embarrassing to write. According to Pinker (2014, p. 287), mistakes in using the comma account for more than a quarter of writing errors in student papers.

One important function of the comma is to separate. The comma separates off phrases and words, but should not be used to separate sentences, in which case it makes a run-on sentence, which is considered ungrammatical as well as not stylish. Phrases that are by-the-way remarks or added thoughts about a noun phrase are separated by commas at both ends. These added phrases can be taken out, commas with them, without affecting the syntax of a sentence. The previous sentence itself illustrates a case of an added phrase enclosed by commas. Here are some more examples:

- 1) John Kennedy, who was the President of the USA in 1963, was assassinated in Dallas.
- 2) Susan was walking in the city centre with a friend, Teresa, when they bumped into Susan's ex-husband.

Note that 2) conveys the sense that Susan was walking with one friend, and by the way, that friend's name is Teresa. Contrast 2) with a slightly different sentence without the separating commas:

- 3) Susan was walking in the city centre with her friend Teresa when they bumped into Susan's ex-husband.

In 3), the identity of Teresa is integral to the sentence. Perhaps, for example, Susan's ex-husband now has romantic interests in Teresa, or perhaps Teresa and the ex-husband work in the same company.

Thus, in contrast, the comma is not used when a phrase describing a noun phrase is integral to the noun phrase, or serves to define the noun phrase. One would write:

- 4) The theorist who first proposed the idea of sexual selection was Charles Darwin.

Not:

- 5) The theorist,* who first proposed the idea of sexual selection,* was Charles Darwin.

A *who*-phrase can serve either as a by-the-way remark (as in 1)) or as a defining, integral phrase (as in 4)), with the difference marked by the commas. In the cases of inanimate noun phrases, the by-the-way remarks, again separated by commas, must be headed by the word *which* rather than the word *that*. One must write:

Methane, which has the chemical formula CH₄, is a potent greenhouse gas.

And not:

Methane, that* has the chemical formula CH₄, is a potent greenhouse gas.

For integral phrases, either *that* or *which* is acceptable nowadays, although some purists would insist on the use of *that*. Thus, one can write:

The chemical that has the formula CH₄ is a potent greenhouse gas, methane.

Or:

The chemical which has the formula CH₄ is a potent greenhouse gas, methane.

The comma also serves to separate a list of adjectives or nouns, representing what would be a natural pause in spoken speech. Take adjectives describing a noun phrase. A list separated by commas indicates that each adjective describes the noun phrase independently and separately, while a list without commas means that the adjectives together describe the noun phrase. Sometimes, the difference does not amount to much. A *big red car* or a *big, red car* expresses similar ideas. But at other times, the separating comma makes a big difference. “The panda gave birth to a second male offspring” speaks of a second offspring that is male. The sentence does not say anything about how many offspring in total the panda has had. For example, she might have already given birth to two previous female offspring. In contrast, “the panda gave birth to a second, male offspring” means that this is the second offspring of the panda, and what is more, this cub is male. We know that that panda had exactly two offspring at the time that the sentence is referring to, and that the second one was male.

For a list of nouns, a list of more than two items needs to be separated by commas, and usually has the word *and* or *or* before the last item in the list. A list of two items is not separated by a comma. Thus,

Deshaun ate a salad and spaghetti bolognese for dinner.

but

Deshaun ate a salad, spaghetti bolognese, and a slice of cake for dinner.

The last comma before the *and*, sometimes called the Oxford comma, is dispensed with in some styles favouring lean punctuation, the argument being that the word *and* is already doing the separating, making the comma redundant. But for reasons of clarity, both Pinker (2014) and I recommend using the last comma. Consider the following sentence without the Oxford comma:

She interviewed two of her university teachers, Ellen DeGeneres and Oprah Winfrey.

One could be forgiven for thinking that DeGeneres and Winfrey had heretofore unknown careers teaching at some university. The Oxford comma makes clear a list of three separate items:

She interviewed two of her university teachers, Ellen DeGeneres, and Oprah Winfrey.

Finally on this theme, when a list contains items that are themselves lists of multiple items, things can get hairy for our poor comma. Thus, it is dizzying to see a list such as:

He was inspired by the work of Lamarck, Wallace, and Darwin, Newton and Einstein, and Marie Curie, Pierre Curie, and Irène Joliot-Curie.

A way out is to borrow a trick from referencing, and enlist the semi-colon as a separator of such multi-item items:

He was inspired by the work of Lamarck, Wallace, and Darwin; Newton and Einstein; and Marie Curie, Pierre Curie, and Irène Joliot-Curie.

On the other hand, the comma should not be used to join separate sentences together, no matter how related the sentences seem to the writer. Thus, the following examples make run-on sentences, which I have marked with asterisks indicating improper grammar.

This was not right, in fact, it was morally wrong.*

She played a great game, she scored two goals.*

He starred in the show, he played a key supporting role.*

These pairs of sentences need to be separated by other punctuation marks. They can be separated by the full stop or period, “.”, such as: “She played a great game. She scored two goals.” Or else a semi-colon, “;”, is also acceptable for sentences that hang together, as is the case with all the above examples: “She played a great game; she scored two goals.”

Another no-no for using the comma is to break up a long sentence whose syntax should not have a comma. The writer might feel like using a comma because it seems like one needs to take a breath at some point in saying the sentence. Commas do not belong in the likes of the following sentences.

The minimalist theory of comma use proposed by Moo et al. (2019),* tells writers to minimise the use of commas.

This complicated series of actions was the wrong thing to do because,* it actually left them worse off than before.

She believed with all her heart and soul,* that she was acting appropriately.

The comma should be deleted from each of these examples.

Concluding words

In the art and craft of writing, the nitty-gritties in this chapter are small embellishments compared with the big picture of classic style and clear writing. It behooves a careful writer to minimise even small errors, and hopefully avoid feeling embarrassed about such mistakes. But logical flow, sound arguments, and a clear picture of the truth are much more important. Pinker (2014) advises writers to look things up, and to make sure that the facts entering into arguments are correct. Conventional wisdom may be misguided in a day and age when many unrefereed sites fill the Internet. Arguments should also be sound, and be based on good reasons. Good style should work to promote good ideas based on solid grounds. I could do no better to end this little volume than quote Pinker’s (2014) final words: good style should work “to enhance the spread of ideas, to

exemplify attention to details, and to add to the beauty of the world.” (p. 304)

References

- Cheng, Ken. 2016. *How animals think and feel*. Santa Barbara: ABC-CLIO.
- Diano, Sabrina. 2018. A new brain circuit in feeding control. *Science* 361 (6397):29-30.
- Pinker, Steven. 2014. *The sense of style*. London: Penguin Random House.
- Strunk Jr., William, and E. B. White. 1979. *The elements of style, third edition*. New York: MacMillan.

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