# A Workshop for Writers in Economics

## and Related Disciplines

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*Chaque toile représente un moment où on a pu,*
*où on a eu la force.*

*Each canvas represents a moment in which one has been able to,*
*in which one did have the force.*

– Bram van Velde[1]

[1] In: Charles Juliet, *Rencontres avec Bram van Velde.*

# Contents

# Preface

Different academic disciplines follow different style conventions. In economics and related disciplines, the style defined in *The Chicago Manual of Style* (published since 1906 by The University of Chicago Press) is most relevant.[2] In addition to the *Manual*, The University of Chicago Press publishes a number of collective and individual works on writing and research. Particularly useful for students are *A Manual for Writers of Research Papers, Theses, and Dissertations* (which appears under the name of Kate Turabian, the author of the original style guide from which it evolved) and *The Craft of Research* by Wayne Booth, Gregory Colomb, and Joseph Williams, three long-term contributors to the *Chicago Manual of Style*.

Writers in economics frequently deal with mathematical arguments, numbers, and data. *The Chicago Manual of Style* contains a chapter on "Mathematics in Type," which is closely related to style recommendations and reflexions on the typesetting of mathematics published by the *American Mathematical Society* (AMS), such as *A Manual for Authors of Mathematical Papers*, Ellen Swanson's *Mathematics into Type*, and the *AMS Style Guide*.

The basis of this workbook is *Chicago* and *AMS style*. The material presented here grew out of a workshop that I have first developed for the PhD program in economics at the University of Vienna in 2009 and that I have since then held for various institutions.

[2] Two other prominent resources for academic writing are the *Publication Manual of the American Psychological Association* ("APA style"), which is commonly used in psychology, the sciences, education, and some areas of the social sciences, and the *The MLA*—the *Modern Language Association—Manual and Guide to Scholarly Publishing*, which is widely used in the humanities, especially modern language and literature studies.

# Chapter 1

# Voice

## 1.1 How to make yourself write: confidence and routine

*This chapter addresses: the fear of not knowing enough – writer's block – confidence – routine – the sound of your voice*

**Reading 1**

- Ernest Hemingway, *A Moveable Feast*, 11–13.
- Jonathan Lethem talks with Paul Auster, in *Believer Book of Writers Talking to Writers*, 25–42.

*Discussion:*

- What do these writers say about routine? Discipline? What do they tell us about methods to keep the process going?
- What do they say about the subconscious—their own and that of the reader?
- What do they tell us about identity? Trust?
- "Do not worry," Hemingway says he would tell himself:

> "You have always written before and you will write now. All you have to do is to write one true sentence. Write the truest sentence that you know." So finally I would write one true sentence, and then go on from there. (Hemingway, *Movable Feast*, 12)

What can be *truth* in fiction writing? What is the implication of that for academic writing? Research?

- What does Hemingway say about reading? And looking?

- Auster says:

> I can even hear the words being written. So much of the effort that goes into writing prose for me is about making sentences that capture the music that I'm hearing in my head. It takes a lot of work, writing, and rewriting to get the music exactly the way you want it to be. That music is a physical force. Not only do you write books physically, but you read books physically as well. There's something about the rhythms of language that corresponds to the rhythms of our own bodies. An attentive reader is finding meanings in the book that can't be articulated, finding them in his or her own body. (Auster in conversation with Lethem, *Believer Book of Writers*, 27)

Is rhythm important for mathematical writing? How do we *talk* mathematics?

- Writers sometimes say that their characters "talk" to them—that their characters pull the story in certain directions, or refuse a path where the writer wanted to take them. Is there something similar going on when we write a research paper? Who are the characters in mathematical writing? Economics writing?

### Workshop 1

*At home.*

Take a piece of writing that you like—an article that is important for your work, that has inspired you, or that has influenced or impressed you in some other way. It does not need to be a paper in your field. Read it and underline all adverbial phrases, like "in addition," "moreover," "similarly," etc. Write them in a notebook—in the order in which they appear in the text, including their surrounding punctuation.

Example:

| | | |
|---|---|---|
| Evidently, ... | At the same time, ... | ..., after all, ... |
| Manifestly, ... | By contrast, ... | ..., notoriously, ... |
| Clearly, ... | Rather, ... | ..., better still, ... |
| Of course, ... | Similarly, ... | ..., however, ... |
| Moreover, ... | Instead, ... | ..., as usual, ... |
| Finally, ... | As a result, ... | ... which, at this stage, ... |
| Not surprisingly, ... | Nonetheless, ... | ..., nevertheless, ... |
| Beyond that, ... | As it happens, ... | ..., in contrast, ... |
| Besides, ... | In general, though, ... | ..., too, ... |

Extension 1: Turn to your current writing project. Can you use any of these words?
Variant: Use them in the order in which you have written them down.

Extension 2: Keep that notebook. Use it to collect words and phrases that seems useful to you or that you just happen to like.

Example:

| | |
|---|---|
| For me, | For us, |
| ..., or else like | Still and all, ... |

## 1.2 Choices

*This chapter addresses: the choices and trade-offs that you face as a writer*

### Reading 2

- Zinsser, "Unity," chap. 8 in *On Writing Well*, 49–54.

*Discussion:*

- Zinsser says:

> You learn to write by writing. [...] All writing is ultimately a question of solving a problem. It may be a problem of where to obtain the facts or how to organize the material. It may be a problem of approach or attitude, tone or style. Whatever it is, it has to be confronted and solved.

  In which sense is this similar to what we have heard from Hemingway?

- What does Zinsser say about unity and choices?

### Workshop 2

*In class, on the blackboard. This exercise can be used to introduce some of the key concepts that structure the rest of the workshop. Assign a scribe, who should type the transcript at home. Distribute copies of the transcript for everybody at the next meeting.*

What are the choices that you face when writing a paper?

Example:

- "I" or "we"? Or "one"? Or avoid the use of any pronoun ?
- Which literature to quote?
- How to organize references?

- For which journal?
- What can I assume that the reader knows?
- Structure, length,
- What to say in the abstract, the introduction, the conclusions?
- Tense: "Krugman shows," "has shown," or "showed"?
- British or American standards for spelling and punctuation?

This workshop is meant as a guide through some of these choices. The focus is not on what is right and wrong but on the trade-offs between various options.

## 1.3 "I" or "we," or "one"?

*This chapter addresses: the choice of pronoun – voice – mood – point of view*

**Workshop 3**

*In class.*

Read (into) the following three articles:

(1) John F. Nash 1950. Equilibrium points in n-person games. *Proceedings of the National Academy of the Sciences of the United States of America* 36, 48–49.

(2) Michael Spence 1973. Job market signaling. *The Quarterly Journal of Economics* 87, 355–374.

(3) Robert Aumann 1976. Agreeing to Disagree. *The Annals of Statistics* 4, 1236–1239.

behavior under "almost common knowledge." *The American Economic Review* 79 (3), 385–391.

Investigate the following questions:

- From which perspective is each of these papers written? Is there an "I" or "we"? Or a "one"? Or does the author avoid the use of any pronoun? Does the author respect unity of pronoun? Who is the voice that is talking? Are the author and the voice that is talking the same?

- If there is a *we*? Who is that *we*? What are the possible registers, or instances, of *we* that can appear in a research paper?

- Does the reader appear in the text? Do any other people who are involved with the production of the article appear in the text?

- Who are the main characters in each of these articles? Does the writer and the reader directly enter into contact with them?

For a further discussion of these three articles see: Pawlowitsch, "Making See."

### Workshop 4

*At home.*

Reread your paper. Do you use "I" or "we," or a passive style avoiding any pronouns? Do you switch between several voices or pronouns? If so, is there a pattern? Do you address the reader? How?

### Reading 3

*Optional.*

Writers and literary critics on voice and point of view:

- William Zinsser, "Style," chap. 4 in *On Writing Well*, 17–23.

- Norman Mailer, "First person versus third person," in *The Spooky Art*, 84–88.

- James Wood, "Narrating," in *How Fiction Works*, 3–11.

*Discussion:*

- Who is telling the story? The choice of pronoun—the identity of the narrator, voice, and point of view—is among the most crucial questions in narrative fiction. Who are you when you write a paper?
- Mailer asks whether a man can write about a man who is braver or tougher than himself, or a woman about a woman who is more sensitive than herself. Is it easier when writing for the sciences?
- Wood talks about *free indirect style*. Is it possible to find *free indirect style* in research paper? Mathematical writing? (In any of the articles indicated in Workshop 3?)

"Making See: A Structural Analysis of Mathematical and in particular Game-Theoretic Writing" contains a paragraph on free indirect style.

## 1.4 Who are you writing for?

*This chapter addresses: The audience – defining your reader – choosing a journal.*

**Reading 4**

- William Zinsser, "The Audience," chap. 5 in *On Writing Well*, 24–31.

*Discussion (possibly in class as a group work):*

- Zinsser says, "You write for yourself." What does he mean by that? Does this make sense for academic writing?
- Who is your reader? Answer the question first in practical terms: Who will effectively be the first reader, the first readers, of your paper? Is there some specific person you would like to reach? Who are the readers that you have to convince first to reach the reader who you would like to reach? Who will he or she think is the reader that you should have in mind? What would you have to assume that this reader knows and does not know?

- What means *unity* with respect to the expected audience?
- What does it mean to address the subconscious of your reader?

### Reading 5

*Optional.*

- Steven Pinker, "The curse of knowledge," chap. 3 in *The Sense of Style*, 57–76.

*Discussion (possibly in class as a group work):*

- Thinking about the curse of knowledge: What do you need to think about in particular when writing mathematics?

### Workshop 5

*At home.*

Take a look at your reference list. What are the three journals from which are most of the articles that you cite? Go on the website of each of these journals. Have a look at their guidelines for authors. Consult the current issue of these journals. In there, can you find any articles that are related to your work? Read their abstracts. Have a look at their reference lists.

## Further Reading

Norman Mailer, *The Spooky Art*.
Steven Pinker, *The Sense of Style*, notably chapters 1–3.
James Wood, *How Fiction Works*.
William Zinsser, *On Writing Well*, notably chapters 1–8.

# Chapter 2

# Structure

*Tell them what you are going to tell them.*

*Tell them.*

*Tell them what you told them.*

– Paul Halmos[1]

*This chapter addresses: the lay-out of a research article*

## 2.1 Doing research

**Workshop 6**

*At home.*

Read Booth, Colomb, and Williams "Moving from a topic to a question to a working hypothesis," chap. 2 in Turabian, *A Manual for Writers of Research Papers, Theses, and Dissertations*, 12–23.

- Collect possible research questions. Try to answer the *So-what?* question.

[1] In the documentary *I want to be a Mathematician*, reciting a "famous triptych."

Rank your questions. If you have already settled on a question and are in the middle of writing a paper, still, answer the *So-what?* question.

- Once you have settled on a question, make an outline of the text to be written by defining its sections. Choose a preliminary title, and start the bibliography.
- If you have some results already, write them down in the form of *slides* for a presentation.

## 2.2 Three-part structure

**Workshop 7**

*At home.*

Read Booth, Colomb, and Williams, "Planning a First Draft," chap. 6 in Turabian, *A Manual for Writers of Research Papers, Theses, and Dissertations*, 62–70. Have another look at the papers discussed above in Workshop 3 or choose two papers that are relevant for your work. For each of these papers, answer the following questions:

- Does the author follow the three-part structure suggested by Booth, Colomb, and Williams?
  - In the introduction, is there a phrase that states the question treated in the paper?
  - When concluding, does the author/do the authors repeat the question treated and the main claim?
  - Where does the author discuss related literature?
- Does the author give answers to *So what?*
- How does the author deal with the formal argument? Does he include proofs in the main body of the text or are proofs given in separate environments? How does he introduce notation?

- Take a look at the paper that you are currently working on. Do you follow the three-part plan? When do you first state your question? When do you first state your main claim?

## 2.3 Introduction and conclusions

**Reading 6**

- Zinsser, "The lead and the ending," chap. 9 in *On Writing Well*, 54–66.
- Booth, Colomb, and Williams, "Revising your draft" and "Writing your final introduction and conclusion," chapters 9 and 10 in Turabian, *A Manual for Writers of Research Papers, Theses, and Dissertations*, 98–108.

## 2.4 The abstract

**Reading 6**

- Paul Auster, *Moon Palace*, first page.

*Discussion:*

– What does the narrator relate to the reader in that first paragraph?

**Workshop 8**

*In class. Match students randomly in pairs. Assign one student in the role of the interviewer and the other in the role of the interviewee.*

Interview your partner about his or her current project. Try to find out: What is the overall topic? What is the specific question that he or she is trying to answer? Does she have a hypothesis? Which methods is she going to use? Does she have already some results? Do they confirm her hypothesis? Then switch roles. Present your partner's project in class.

**Workshop 9**

*At home.*

Read the article by Fay Halpern and James Phelan "Writing an Effective Abstract: An Audience-Based Approach." Write your abstract using not more than 300 words.

**Workshop 10**

*In class, at the following session.*

Write your abstract using not more than 250 words.

## 2.5 Connecting parts

When moving from one section to the next, writers often use one of the two devices:

(1) Start a new section by taking up the conclusion of the previous section,

(2) end a section by spelling out the topic that will be treated in the following section.

Here is an example of the first:

> In chapters 1 and 2, I sketched out an augmented Reichenbachian theory of tense. I argued that theories of this kind enjoyed reasonable empirical support if appropriately constrained by principles such as the Constraint on Derived Tense Structure. In this chapter I will focus on the fine structure of the theory, concentrating on two themes: First, ... [Hornstein 1990, p. 81, beginning of chapter 3.]

An example of the second:

> In short, only a few areas of the world developed food production independently, and they did so at widely different times. [...]

> How can we explain these geographic differences in the times and modes of onset of food production? That question, one of the most important problems of prehistory, will be the subject of the next five chapters. [Diamond 1997, p. 105, end of chapter 5]

Sometimes though a writer does *not* want to build an arc leading over from one section to the next but on purpose wants to mark a break—because a new thought starts. Coherence is important. But that does not mean that there has to be one single thread that runs through the exposition. Sometimes it is more convenient to develop two thoughts independently and bring them together only lateron. This might be helpful not only for the writer but also for the reader. For the reader too it is difficult to keep one thought in mind over a long distance and constantly work new incoming information into it. If it is the case that a new chapter, section, or paragraph introduces a new idea, it is helpful to mark this, either by saying it explicitly or by signaling it indirectly, for instance, by opening that paragraph with an observation or reflection that is distinctively different from what has been said before. Some writers amplify this effect by changing the tone or rhythm of their voice. This kind of signposting or signaling is important, because if a reader does not understand that a new thought starts, she might look out for the connection to the previous part, and, if she can't find one, might think that she has missed something, which might block her in her understanding or even stop her in her reading. If, instead, you make it clear to your reader that a new thought starts, you not only help her to orient herself in the text, you also give her a moment of pause, as if telling her: "Ok, you can relax now for a moment. A new thought starts. Later we will see how it connects to what has been said so far. For the moment, breath, clear your mind, and let me tell you something new."

## 2.6 Tools and habits

- **Slides.** Present your work first in the form of slides for a talk.
- **Building blocks.** Academic writing is structured writing. This has advantages: Start with what you know best or can consider as surely

acquired (definitions, the main result and its proof). If you find yourself stuck, do those things that you have to do anyway: check your equations, organize your references; etc.

- **Write and cut.** Similarly to what directors do when making a movie: Produce as much material as you need: write, explain in as many words that come to your mind, produce examples, etc. Then cut: Print out your draft. Read it section-wise. Edit it section-wise, with a pen on the print-out. Cut what feels too much, superfluous, to you as a reader.

- **Before revising—read.** Read some piece of writing that feels to you as if you could have written (an article in a magazine, an essay, a chapter in a book, a novel).

- **Re-search.** Writers sometimes get stuck when they try to say something that they have not understood themselves. If there is such a moment, try to formulate what precisely it is that you do not understand. Then, do more research, trying to answer that specific question.

- **Take the responsibility.** One source of difficult-to-read writing is that a writer repeats what he or she has read without having understood it but supposes that everybody else understands, notably those who are or should be more knowledgeable than he or she is. Do not let this happen. Take the responsibility for your text. If you realize that you use a phrase or term that you do not understand, do more research to find out what it is supposed to capture or refer to. Once you have understood, ask yourself if there is a better way of putting it into words. Discuss this with your colleagues. If changing the wording seems unwise, try to see if, given the intended audience and the scope of the piece, it makes sense to include an explanation, possibly only indirectly by the specific choice of words in the surrounding text. Some readers might be greatful to you, maybe even some of those of whom you think they already understand. If your advisor, or an editor, later tells you that such explanations are not necessary given the audience, you can always cut that extra phrase. But you know that it is there. (Think of what we have heard Hemingway say.)

An example from game theory: "Out-of-equilibrium beliefs" (used, for instance, by Kreps and Ramey 1987, *Econometrica*). To my mind, it is better to replace this term by "beliefs off the equilibrium path." What is referred to by "out-of-equilibrium beliefs" are beliefs about the state of nature (for instance, the type of a player, like high or low productivity worker) at an information set that is not reached along the path through the game actually taken in the equilibrium under study—an information set "off the equilibrium path." Beliefs at such an unreached information sets are in fact not "out of equilibrium," instead they *support* the equilibrium in question (they ensure that not taking the action that leads to that information set is a best response for the player in question). Referring to them as "out-of-equilibrium" beliefs is truly misleading.

Remember Zinsser:

"You learn to write by writing."

"Who are you *not* to say what you think?"

## Further Reading

Steven Pinker, *The Sense of Style*, notably chapter 5.
Kate Turabian, *A Manual for Writers of Research Papers, Theses, and Dissertations*, notably chapters 1–10.
William Zinsser, *On Writing Well*, notably chapter 9.

# Chapter 3

# References

*This chapter addresses: How to organize references and when to put a reference*

**Workshop 11**

Get a paper from a leading journal in (1) economics, (2) philosophy, and (3) the sciences. How do these papers handle notes and references? Which one looks more familiar to you? Which one do you prefer? Why?

## 3.1 Two basic systems

*The Chicago Manual of Style* describes two basic systems: (1) notes and bibliography, and (2) the author-date system.

### (1) Notes and bibliography

Chicago recommends this system for literature, history, and the arts. Bibliographic citations are provided in notes—footnotes or endnotes—possibly supplemented by a bibliography.

First note citation (footnote or endnote) in a work *without* full bibliography:

1. Zinsser, William. *On Writing Well*, 30th anniversary ed. (New York: Harper Collins, 2006), 26.

The number after the title of the work, 26 in the example above, refers to the page in the text.

First note citation (footnote or endnote) in a work *with* full bibliography:

1. Zinsser, *On Writing Well*, 26.

Bibliographic entry:

Zinsser, William. *On Writing Well*, 30th anniversary ed. New York: Harper Collins, 2006.

### (2) The author-date system

Chicago recommends this system for the physical, natural, and social sciences.

Text citation:

In general, an evolutionarily stable strategy need not be a strict Nash-equilibrium strategy. In asymmetric games, however, strict Nash equilibria *coincide* with the evolutionarily stable strategies (Selten 1980).

Reference-list entry:

Selten, R. 1980. A note on evolutionarily stable strategies in asymmetric animal contests. *Journal of Theoretical Biology*, 84:93–101.

## 3.2 Bibliographies and reference lists

Bibliographies and reference lists are usually ordered *alphabetically* by the last name of the first author or editor. The name of the first author is inverted. (Some journals invert the names of all authors.) A single-author entry precedes a multi-author entry beginning with the same name, and for successive entries by the same author(s) or editor(s), a so-called 3-em dash replaces the name(s) after the first appearance.

Reference list in the author-date style:

Pinker, Steven. 1994. *The Language Instinct*. New York: William Morrow and Company.

———. 1997. *How the Mind Works*. New York: Norton.

Pinker, Steven, and Ray Jackendoff. 2005. The faculty of language: what's special about it? *Cognition*, 95:201–236.

### Remarks on typesetting references in LaTeX

- The dash between page numbers, as in 84:93–101, is a so-called *en dash* (see *The Chicago Manual of Style*, Chapter 6, 261). In LaTeX you produce it by the command `--` (two single dashes without space between).
- The 3-em dash, ———,

  can be produced by the command: `\rule[3pt]{3em}{.5pt}`

## 3.3 Alternative systems

There is a third system, mostly used in the natural, medical, and biomedical sciences, in which references are given in a list at the end of the article and are indicated in the text by numbers in round or square brackets *in the order in which they appear in the text*.[1] For example, [1] stands for the first citation that appears in the text, and the corresponding reference is given as the first entry in the list; [2] stands for the second, etc.

First text citation:

Yet politeness and other forms of indirectness in speech appear to be universal or nearly so (1).

Corresponding note at the end of the text:

[1] This is how references are given in APA style.

1. Brown P, Levinson SC (1987) *Politeness: Some Universals in Language Usage* (Cambridge Univ Press, New York).

A characteristic of this system is its economy: punctuation is minimalist, and journal articles are given only by the authors' names, year of publication, and the name, number and page number of the periodical in which they appeared (the title of the article is suppressed).

1. Young HP (1988) *Am Pol Sci Rev* 82:1231–1244.

## 3.4 Specific journals

Most journals in economics will use a variant of the author-date system. There are small variations as far as font, punctuation, and conventions for giving journal titles and authors' names go. For example, some journals require journal titles to be given in abbreviated form; some invert the name of all authors, some of the first author only, etc. Before submitting a paper to a journal, always check the specific journal's information or *Guidelines for Authors*.

## 3.5 When to put a reference?

Every result that you cite or use and every claim that you make that is not yours needs a reference. There are certain exceptions, namely when a result has made it into the canon of a field. For example, nowadays, in articles published in game theory journals, Nash (1950) is rarely cited.

#### Workshop 12

Go to the web site of three leading journals in your field. Look up their guidelines for authors and check the information that they give for handling notes and references. Write a reference list with 5 entries that you cite in your work in the style of each of these journals. (Use the same 5 entries for the list in the style of each of these journals.) At least one of these entries should be a journal article, one a book, and one a work by more than one author.

Example:

**Econometrica**

Aumann, R. J. (1976): Agreeing to Disagree. The Annals of Statistics 4, 1236–1239.

Crawford, V. P., and J. Sobel (1982): Strategic Information Transmission. Econometrica 50, 1431–1451.

Kreps, D., and J. Sobel (1994): Signalling, in Handbook of Game Theory, ed. by R. Aumann and S. Hart. Amsterdam: Elsevier, 281–304.

Samuelson, L. (1997): Evolutionary Games and Equilibrium Selection. Cambridge, MA: MIT Press.

Young, H. P. (1993): An Evolutionary Model of Bargaining, Journal of Economic Theory, 59, 145–168.

**Games and Economic Behavior**

Aumann, R. J., 1976. Agreeing to disagree. The Annals of Statistics 4, 1236–1239.

Crawford, V. P., Sobel, J., 1982. Strategic information transmission. Econometrica 50, 1431–1451.

Kreps, D., Sobel, J., 1994. Signalling. In: Aumann, R., Hart, S. (Eds.), Handbook of Game Theory. Elsevier, Amsterdam/New York, pp. 281–304.

Samuelson, L., 1997. Evolutionary Games and Equilibrium Selection. MIT Press, Cambridge, MA.

Young, H. P., 1993. An evolutionary model of bargaining. J. Econ. Theory. 59, 145–168.

**American Economic Review**

**Aumann, Robert J.** 1976. "Agreeing to disagree." *The Annals of Statistics* 4: 1236–1239.

**Crawford, Vincent P., and Joel Sobel.** 1982. "Strategic Information Transmission." *Econometrica* 50(6): 1431–1451.

**Kreps, David, and Joel Sobel.** 1994. "Signalling." In *Handbook of Game Theory* Vol. 2, ed. Robert Aumann and Sergiu Hart, Amsterdam: Elsevier.

**Samuelson, Larry.** 1997. *Evolutionary Games and Equilibrium Selection*. Cambridge, MA: MIT Press.

**Young, H. Peyton .** 1993. "An evolutionary model of bargaining." *Journal of Economic Theory* 59: 145–168.

## Reprint editions and modern editions

*The Chicago Manual of Style* says: "When citing a reprint or modern edition in the author-date system, the writer (or editor) must decide whether text citations should give the original date, the later date, or both. Context usually determines the choice, but as long as the referece list gives full details, most readers will be comfortable with any of the following practices."

Text citation:

> (Darwin 1859)

Reference list:

> Darwin, Charles. 1859. *On the Origin of Species.* Facsimile of the 1st ed., with introd. by Ernest Mayr. Cambridge, MA: Harvard University Press, 1964.

Text citation:

> (Emerson [1836] 1985)

Reference list:

> Emerson, Ralph Waldo. [1936] 1985. *Nature.* A facsimile of the first ed., with an introd. by Jaroslav Pelikan. Boston: Beacon.

## Further Readig

*The Chicago Manual of Style*, part three "Documentation", 651–860.
Turabian, *A Manual for Writers of Research Papers, Theses, and Dissertations*, part II, "Source citation," 132–280.

# Chapter 4

# Using words

*This chapter addresses: the micro structure of writing: words and phrases – punctuation – elements of grammar – usage*

## 4.1 British or American standard for rules of spelling and punctuation?

Follow either British or American standard. But do not mix them. Coherence is most important. Particular care has to be taken when working with material from different sources. Writers sometimes have the tendency to imitate the style and tone of some work they are writing about or referring to, which might go up to imitating spelling and punctuation.

If you are preparing a manuscript for submission to a journal or a book publisher, look up the guidelines for authors at the journal's or publisher's website. Most, but not all, journals in the sciences, mathematics, economics, and related disciplines use American standard. If you are writing a term paper or working on your thesis (and in most cases, your thesis will be composed of three papers that have to fulfill the requirement of being potentially submitted to a journal), find out what is the standard used by the journals that are most important in your field and base your choice on that.

This section, as the rest of this workshop, is based on American standard as recommended by *The Chicago Manual of Style*. For British standard see,

for instance, *The Oxford Style Manual*.

## 4.2 Punctuation

### Workshop 13

Read the article "The greatest journey" by James Shreeve in *The National Geographic, March 2006*. Take a pencil and circle all punctuation marks. Discuss the author's use of punctuation marks: Is there anything that strikes you as interesting or odd about the author's use of punctuation marks? Do you perceive any inconsistencies?

### Reading 8

- Roy Peter Clark, "Let punctuation control pace and space," chap. 9 in *Writing Tools*, 45–49.

*Discussion:* In his opening statement Clark says: "Some teach punctuation using technical distinctions, such as the difference between restrictive and nonrestrictive clauses. Not here. I prefer tools, not rules." Discuss this in relation to what he says, and does, in the rest of the chapter.

Punctuation has various functions: it marks rhythm but it also helps to define units of meaning. Sometimes these two functions coincide; sometimes a punctuation mark actually *is* a unit of meaning. But sometimes they don't. When we read words from a page, the rhythm and ease in which we do that is governed also by the physical aspect of the string of letters that we sees on the page. Rules for punctuation are therefore governed by: prosody, semantics, and aesthetics.

With so many factors intervening, different rules might emerge—as a function of which one is given precedence in which situation. There are differences not only between British and American English, but also between domains for which people write, for example, literature, journalism, or academic writing. In addition to that there are changes over time. In general,

people punctuate more today than they did some time ago, and they punctuate more in academic writing than in other fields. Punctuation in American standard has the particularity that it allows aesthetic considerations to go against "logic." (The period after "logic" is a case in point: in American standard, periods and commas go *inside* closing quotation marks.)

If you oppose a certain rule that is part of the style convention in which you write, it might be a reasonable choice not to apply it. But know that it exists. And know that some editor might pay attention to it.

Again, Coherence is most important and particular care has to be taken when working with material from different sources; notably, when paraphrasing or—a source of mistake often forgotten—when copy-pasting your own material. Even established researchers are sometimes not aware of the rules of punctuation, hence do not see it when, for instance, a technical editor has adapted the punctuation of one of their texts to some required standard, and therefore, when they copy-paste from different of their own texts, do not realize that they end up, for example, with periods and commas sometimes in and sometimes outside closing quotation marks.

## Some useful rules

Particularly important and conductive are those rules that are based on grammar or help to constitute differences in meaning. Knowing those rules is useful, because they give structure and often help a writer to resolve ambiguities or indecision where intuition provides no answers. In the following I have selected some of those rules from the *Chicago Manual of Style* and give examples for their use in economics writing.

**Relative clause and main clause.** A relative clause that precedes a main clause should be followed by a comma.

> If the utility function is quasi-concave, the individual's maximization problem will have a unique solution.

A relative clause that follows a main clause should not be preceded by a comma.

> The individual's maximization problem will have a unique solution if the utility function is quasi-concave.

If the same actor appears in both clauses (once as a noun, once as the relative pronoun of that noun), the first form is often preferable.

> If $f$ is convex, it will attain a maximum on $X$.

A relative clause that follows the conjunction between two coordinate clauses is usually followed but not preceded by a comma.

> The game will have a Nash equilibrium in mixed strategies, and if $\alpha$ is smaller than $0.4$, it will have a unique pure-strategy Nash equilibrium.

> The matrix $P$ assigns to every event $i$ one of the rows of $M$, or if we allow for mixed strategies, a convex combination of the rows of $M$.

In close punctuation, a comma can be put before the relative clause (earlier versions of the *Chicago Manual of Style* allowed for this.)

> The game will have a Nash equilibrium in mixed strategies, and, if $\alpha$ is smaller than $0.4$, it will have a unique pure-strategy Nash equilibrium.

> The matrix $P$ assigns to every event $i$ one of the rows of $M$, or, if we allow for mixed strategies, a convex combination of the rows of $M$.

However, the relative clause ("if $\alpha$ is smaller than 0.4," "if we allow for mixed strategies") then looks more like a parenthetical remark. A useful guideline is to put a comma before a relative clause that follows the conjunction between two coordinate clauses only if the relative clause can be considered a parenthetic remark.

> The individual's maximization problem then is well defined, and, if the usual conditions on the utility function are met, the game will have a unique equilibrium.

**Restrictive and nonrestrictive relative clauses.** A relative clause is *restrictive* if it narrows the category it refers to. A relative clause is *nonrestrictive* if it *does not* narrow the category it refers to but provides additional or optional information.

> The game that we have seen above has one Nash equilibrium: (A,A).
>
> The *Prisoner's Dilemma*, which we have seen above, has one Nash equilibrium: (D,D).

In the first sentence, the relative clause "that we have seen above" serves to identify the game for which the claim that follows (that there is one Nash equilibrium) is true—it is restrictive. In the second sentence, the relative clause "which we have seen above" does not further specify the category "the Prisoner's Dilemma" (what is "the Prisoner's Dilemma" is already sufficiently defined by its name); instead it just reminds the reader that the game "the Prisoner's Dilemma" has already been introduced earlier in the text—it is nonrestrictive. The claim that follows (that there is one Nash equilibrium in which both players play D) is true for the entire category "the Prisoner's Dilemma."

A restrictive relative clause is not preceded by a comma—unless the comma is requested by some higher-order structure of the sentence.

> The element $s^{ij}$ is a *choice* that player $i$ has at his information set $j$.

Putting a comma before "that" in the sentence above would be *wrong*. However, a comma before "that" might be justified by an interjection.

> The element $s^{ij}$ is a *choice*, we also say an *action*, that player $i$ has at his information set $j$.

In these cases, it might be better to set off the interjection by em-dashes or parenthesis.

> The element $s^{ij}$ is a *choice*—we also say an *action*—that player $i$ has at his information set $j$.
>
> The element $s^{ij}$ is a *choice* (we also say an *action*) that player $i$ has at his information set $j$.

An interjection can also mandate a comma after "that."

> We base our claims on principles of reasoning that, we hope, our readers accept as sound.

A restrictive relative clause is neither followed by a comma—unless the comma is requested by some higher-order structure of the phrase.

> In the game that we have see above, whatever the choice of $\alpha$, there is always a unique Nash equilibrium.

The comma after "above" is not mandated by the relative clause ("that we have seen above") but is needed to set off the parenthetical remark "whatever the choice of $\alpha$." However, even if the relative clause is taken out, a comma after "above" will still be needed, namely, to set off the introductory adverbial phrase ("In the game that we have see above") from the main clause ("there is always a unique Nash equilibrium).

> In the game that we have see above, there is always a unique Nash equilibrium.

A *nonrestrictive* relative clause, on the other hand, is both preceded and followed by a comma or some another punctuation mark. Alternatively, a nonrestrictive relative clause can be enclosed by dashes or parenthesis.

> In the Arrow–Debreu model, which is the classical reference point for modern mathematical economics, equilibria are always Pareto optimal.

> In the Arrow–Debreu model—which is the classical reference point for modern mathematical economics—equilibria are always Pareto optimal.

> In the Arrow–Debreu model (which is the classical reference point for modern mathematical economics) equilibria are always Pareto optimal.

Whether a relative clause is preceded by a comma or not, that is, whether it is used nonrestrictively or restrictively, can change the meaning of a phrase.

> There is only one equilibrium in which player 1 chooses $A$.

Means that there exists only one equilibrium that satisfies the condition that player 1 chooses $A$. (There might be other equilibria in which player 1 chooses another strategy.)

> There is only one equilibrium, in which player 1 chooses $A$.

Means that there is a unique equilibrium, and in this equilibrium, player 1 chooses $A$. If this is what you want to say, it might be better to just say it like that. Precise wording is important, specifically when it comes to definitions and results. In the flow of your work, it might be clear what you want to say (whether there is only one equilibrium that satisfies the condition that player 1 chooses $A$, while there might be other equilibria, or whether the game has a unique equilibrium, which is of the form that player 1 chooses $A$). Keep in mind, however, that some readers will not read your paper from beginning to end, but just look look up a specific result.

**Relative clauses with "which" or "that"?** In American English usage, specifically in scientific writing, "that" is preferably used restrictively, and "which" (preceded by a comma) nonrestrictively. "That" can never be used nonrestrictively.

> If $(\hat{s}^{-ij}, s^{+ij})$ is a strategy in the set $C[(s^{-ij}, s^{+ij})]$, which includes $(\check{s}^{-ij}, \check{s}^{+ij})$ itself, then ..

> If $(\hat{s}^{-ij}, s^{+ij})$ is a strategy in the set $C[(s^{-ij}, s^{+ij})]$ that *precludes* $I^{ij}$ from being reached, then ..

In the first sentence, $(\hat{s}^{-ij}, s^{+ij})$ is an element of the set $C[(s^{-ij}, s^{+ij})]$, and we are reminded that this set has the property to include strategy $(s^{-ij}, s^{+ij})$ itself. In the second, $(\hat{s}^{-ij}, s^{+ij})$ is an element of a *subset* of $C[(s^{-ij}, s^{+ij})]$, namely the set of those strategies $(\hat{s}^{-ij}, s^{+ij})$ that do not preclude $I^{ij}$ from being reached.

The word *that* serves also as a subordinating conjunction.

> We have seen above that the Prisoner's Dilemma has only one Nash equilibrium.

In that function it is also neither preceded nor followed by a comma—unless a comma is mandated by a higher-order structure.

> They argue, not without referring to the arguments proposed by their opponents, that this conclusion was wrong.
>
> Using a two class model they concluded that, for a wide range of plausible assumptions, there was no stable Nash equilibrium.

**Adverbial phrases.** An adverbial introductory phrase is frequently followed by a comma.

> Because of the finite population structure, we cannot apply Maynard Smith's notion of evolutionary stability.

The comma can be omitted after a short introductory adverbial phrases.

> For thirty years the Arrow-Debreu model has been the central reference point.

In scientific writing it has become usage to put a comma routinely even after short adverbial introductory phrases.

> However, this has to be shown yet.
>
> Therefore, the individual's maximization problem has a unique solution on $X$.
>
> In Section 2, we will ...

These short adverbial phrases can also be moved into the middle of the phrase.

> This, however, has to be shown yet.
>
> The individual's maximization problem, therefore, has a unique solution on $X$.

An introductory adverbial phrase should not be followed by a comma if the sentence is inverted and the verb immediately follows the phrase.

> In the denominator stands the average fitness function.

**Participial phrases.** A participial phrase should be followed by a comma unless the sentence is inverted and the verb immediately follows the phrase.

> Taking limits on both sides, we see that the equation reduces to (5).
>
> Also relegated to the appendix is an extension of the model with a continuum of signals.

Keep in mind that a participial phrase modifies the subject of the main clause. In the first sentence above, the subject of the main clause is "we."

> Taking limits on both sides, the equation reduces to (5).

The sentence above is, on a close reading, grammatically wrong. Its subject is "the equation." But it is not the equation who is taking the limits.

When a participial phrase acts as the subject of the sentence, then that subject should of course also not be separated from its verb by a comma.

> Omitting unused strategies is an effective way to determine the index of an equilibrium.

But:

> Omitting unused strategies, we infer that the equilibrium E1 has index $+1$.

### Workshop 14

*At home.*

Read: "Punctuation," chap. 6 in *The Chicago Manual of Style*. Choose 12 rules that you find particularly important, or interesting. Summarize them and find examples for their application from your field.

### Correct commands for punctuation marks in LaTeX

| Punctuation mark | in print | in LaTeX code |
|---|---|---|
| hyphen | Nash-equilibrium outcome | `Nash-equilibrium outcome` |
| en dash | pages 2–7 | `pages 2--7` |
| em dash | This equilibrium—if it exists—will be Pareto dominated. | `This equilibrium---if it exists---will be Pareto dominated.` |

## 4.3 Grammar and usage

#### Reading 9

- Steven Pinker, "The web, the tree, and the string," chap. 4 in *The Sense of Style*, 77–138.

### Modifiers

A modifier is an element of a sentence that describes or qualifies some other element. "Modifiers," as Pinker explains, "can add comments on time, place, manner, or quality of a thing or an action." The most common modifiers are adverbs and adjectives, but a noun or a phrase (often this will be an adverbial or participial phrase) or a dependent clause can act as one too.

#### Workshop 15

*In class.*

Read the following sentences:

(1) We nearly run the experiment 200 times.

(2) The incumbent faces lower unit costs because it only needs to rent two units of the capital good.

(3) While preparing the questionnaire, the subjects arrived.

(4) Here are five strategies to reduce the number of procedures suggested by the Commission.

(5) Defining your symbols clearly strengthens your argument.

What is wrong, or problematic, with these sentences?

Discuss in class:

In the examples above, the modifying element does not act on what is supposed to. Sentences (1) and (2) are examples of a *misplaced modifier*: the modifier is in the wrong position relative to what it should be affecting. Alternatives that have the modifier in the right position are:

(1) We run the experiment nearly 200 times.

(2) The incumbent faces lower unit costs because it needs to rent only two units of the capital good.

Sentence (3) is an example of a *dangling modifier*: the entity to be modified (the researchers who run the experiment) is absent from the sentence.

(3) While we were preparing the questionnaire, the subjects arrived.

Remark: It is not generally the case that all participial phrases where the "doer" is absent are problematic.

> Comparing (a) with (b) shows that (a) is not only shorter but also easier to comprehend than (b).

The sentence above is grammatically correct: the action of *comparing* is the subject of the sentence; the verb *show* the predicate of this subject—and that is perfectly fine.

In (5) it is not clear what the modifier modifies. What is suggested by the Commission—*five strategies* or *the procedures*? When we read, we have a tendency to apply modifiers to the closest smallest unit of sense to which they possibly apply. As the sentence stands, we have a tendency to apply

*suggested by the Commission* to *the procedures*. If this is what has to be expressed, good. If *suggested by the Commission* applies to the five strategies, a possible alternative is the following:

(5) Here are five strategies that the Commission suggest to reduce the number of procedures.

### Workshop 15'

*At home.*

What is wrong or problematic with the following sentences?

(1) We almost recruited 500 subjects.

(2) Each consumer only derives utility from the first unit of the good that she consumes.

(3) We may only consider the linear approximation for $F$ and ignore higher-order terms in $\varepsilon$ and $\delta$.

(4) Augmenting competition clearly leads to more efficiency.

(5) Taking into account earlier impossibility results, the arrival of these new methods marks a considerable step forward.

(6) We consider a game with a finite number of players and finite strategy sets under uncertainty.

Here are alternatives to the sentences above that have the modifier in the right position:

(1) We recruited almost 500 subjects.

(2) Each consumer derives utility only from the first unit of the good that she consumes.

(3) We need to consider only the linear approximation of $F$ and may ignore higher-order terms in $\varepsilon$ and $\delta$.

We may restrict attention to the linear approximation of $F$ and ignore higher-order terms in $\varepsilon$ and $\delta$.

In the original sentence, "only" modifies the action of "considering." But this is not what the author wanted to express, for "may only" means not being allowed to do anything that goes beyond the action that "may only" refers to. What the author wanted to express is that it is enough to consider the linear approximation of $F$.

(4) If "clearly" applies to the entire statement, the original sentence is probably good. If "clearly" is to apply to the increase in competition, a possible alternative is the following:

A pronounced increase in competition leads to more efficiency.

(5) Taking into account earlier impossibility results, we can say that the arrival of these new methods marks a considerable step forward.

(6) We consider a game under uncertainty with a finite number of players and finite strategy sets.

## Agreement

### Workshop 16

*In class.*

Read the following sentences:

(1) The indeterminacy resulting from multiple equilibrium prices are a problem in all these models.

(2) The rise in prices have not affected consumption yet.

(3) Multiple equilibria is the problem.

(4) When we read, we have a tendency to apply modifiers to the smallest closest unit of sense to which it possibly applies.

(5) The entire family of normal-form truncations associated to it get deleted.

(6) Each of these functions are integrated with respect to $x$.

Is anything wrong with them? If yes, what is it?

## Coordination

| **Original phrase** | **Correct phrase** |
|---|---|
| This will both impact inflation and unemployment. | This will impact both inflation and unemployment. |
| This not only works in an evolutionary model but also in a model with rational players. | This works not only in an evolutionary model but also in a model with rational players. |
| Payoffs can be either in terms of money or emotional rewards. | Payoffs can be in terms of either money or emotional rewards.<br><br>Or:<br><br>Payoffs can be either in terms of money or in terms of emotional rewards. |
| Bidders not only care about their payment and about winning the object, but also about what the auction outcome reveals about their type to outsiders. | Bidders care not only about their payment and about winning the object, but also about what the auction outcome reveals about their type to outsiders.<br><br>Or:<br><br>Bidders not only care about their payment and about winning the object, but also care about what the auction outcome reveals about their type to outsiders. |

## Prepositions

Some words—most often *verbs* and *adjectives* but also *nouns*—require certain *prepositions*. For linguists this is a particular form of *government*.

**Workshop 17**

*At home.*

*The Chicago Manual of Style* (chapter 5, "Grammar and Usage," section on "Word Usage") contains a list of words (plus the prepositions that they require) that often given writers trouble. Work through that list. Write down those that you might have trouble with or that seem important to you for some other reason. (At least 10). Keep that list. Add words plus their propositions that you come along as you read and work and that raise your attention.

Example:

accompanied *by* [not *with*] someone or something else

> During those years, economic growth was accompanied by an increase in unemployment.

account *to* a person; *for* a thing or a person

> The commission has to account to the president for its decisions.

*admit* in the sense of "acknowledge" is a transitive verb; it takes no preposition

> He admitted his failure to cut costs.

*admit* in the sense of "let in": *to*, *into*

> He was admitted to Harvard.

*admit* in the sense of "allow": *of*

> The model with externalities admits of a more detailed analysis.

*compare* in the sense of a literal comparison: *with*; in a poetic or metaphorical sense: *to*

> Comparing (3) with (4) shows that (3) is not only shorter but also easier to interprete than (4).
>
> We can compare the no-signaling equilibrium to a no-trade equilibrium.

something consist *of* components; *in* qualities

> The solution consists of silver cyanide, potassium cyanide, potassium carbonate, and water.
>
> The solution consists in rising wages and extending opening hours.

something or somebody is different *from* something of someone else

> This is different from the solution that we have obtained above.

something is dissimilar *to* [not *from*] something else

> This is dissimilar to the solution that we have obtained above for game I.

something is equivalent *to* [preferably not *with*] some other thing *in* some quality

> The extensive form in figure 3 is equivalent to the one in figure 2. The two approaches are equivalent in their treatment of costs of signals.

something is independent *of* [not *from*] something else

> This result is independent of the initial condition.

to trade *in* or *with* something (in the sense of "doing business with"); *on* some market

> He trades in government bonds.
>
> She trades with art on e-bay.

Not in the list but found elsewhere in *The Chicago Manual of Style*:

to trade $A$ for $B$ [you give away $A$ and get $B$ in return]

> The marginal rate of substitution is the rate at which you are willing to trade one good for another.

to replace $A$ *with* or *by* $B$ [$A$ goes away and $B$ takes its place]

> Key to their success was to replace unskilled workers with skilled workers.

to substitute *B for A* [*B* goes where *A* was before]

> Substituting Z for the expression in the denominator, we get the desired result.

Extra care is needed when the word and the preposition it demands are not next to each other but separated by some other parts of the sentence.

> The solution consists, in almost all cases, in rising wages and extending opening hours.

Chicago recommends to avoid overuse of prepositions. A good ratio to strive for, Chicago says, is one preposition for every ten to fifteen words. Chicago suggests five strategies to reduce the number of prepositions:

- If the surrounding text provides sufficient context, it might be possible to eliminate a prepositional phrase. For instance, in a passage on a particular game-theoretic model, *a strategy of player 1 for this game is a function from events to actions* can be reduced to *a strategy of player 1 is a function from events to actions.*

- Nominalizations of verb forms, sometimes called *buried verbs*, which often require prepositions, can be replaced by the noun's verb form. For instance, *the company's efforts towards cutting costs* can be replaced by *the company's effort to cut costs.*

- An adverbial phrase may be replaced by an adverb; for instance, *with considerable effort* can be replaced by *meticulously, carefully.*

- A phrase with "of" may be replaced by a genitive; for instance, *the high type of player 1* can be replaced by *player 1's high type.*

- Using active voice may eliminate prepositions; for instance, *M will be spanned by P* can be replaced by *P will span M*.

### Workshop 17'

*At home.*

Have a look at your text. What is the ratio of prepositions? Apply the five strategies suggested by Chicago to reduce the number of prepositions. Give five examples.

Example:

> What intrigued economists about Spence's (1974) investigation was the finding that the private returns to the economic variable that functions as a signal exceed the contribution to productivity of that variable.
>
> What intrigued economists was the finding that the private returns to the economic variable that functions as a signal exceed that variable's contribution to productivity.

## Compounds and hyphenation

### Workshop 18

*At home.*

Take one of your textbooks (it should be one published by a main press). Look at the index. For each letter, write down the first hyphenated word. Which compound words get hyphenated? Are the hyphens always of the same length? Do you perceive any regularities?

Example:

> *Arrow–Debreu model*
>
> *backward-bended demand curve*
>
> *concavity–convexity assumption*

Observation:

*Arrow–Debreu* has en em dash (in LaTeX: `--`)
*backward-bended* has a simple hyphen (in LaTeX: `-`)

In English, compounds can be written open, closed, or hyphenated.

**Open compounds:**

Nash equilibrium (n.)
tenure track (n.)
up to date (adj.)
home page (n.)

**Closed compounds:**

breakthrough (n.)
partnership (n.)
counterobjection (n.)
website (n.)

**Compounds formed with a hyphen:**

mass-produced (adj.)
trade-off (n.)

Compounds get closed or linked by a hyphen to indicate that what they are referring to belongs together—is one thing, action, or quality. Sometimes it is not clear, or a matter of interpretation, if the combination of, say, a thing and a quality makes up a new thing or remains just what it is: a thing modified by a quality. Different speakers might have different mental representations of this. For instance, you may understand a *Nash equilibrium* as a compound noun (in this case, an open compound noun), or as a noun (an *equilibrium*) that happens to be modified by the adjective *Nash*. (Which of the two representations you have might depend on your native language.) Sometimes such mental representations seem to change collectively. For instance, some years ago, *web site* was two words. Now it's one word: *website*. Whether the combination of two words that expresses one concept collapses into one word or stays two words is sometimes a matter of aesthetics, sometimes random. For example, Chicago recommends to write *website* as one word but *home page* as two words.

There are some rules though based on word category and grammar. For

instance, *trade-off* gets a hyphen as a noun; but as a verb, to *trade off* is just what it is: a verb plus its preposition.

> The firm faces a trade-off between increasing productivity and cutting costs.
>
> The firm has to trade off higher productivity against lower costs.

*Nash equilibrium* is an open compound as a noun, but if it comes to modify another noun, it will get a hyphen (*Nash-equilibrium outcome*).
Compounds built with prefixes are normally closed (*suboptimal*, *hypergeometric*), but if the prefixed word is a proper noun or an open compound, the new compound word it built with a hyphen (*sub–Saharan*, *post–World War II*).

Understanding the rules based on word category and grammar is important to avoid wrong generalizations. For instance, if you work on international development and use the word *sub–Saharan* often, you might come to think that all words prefixed with *sub*, and by extrapolation, all words with some Latin prefix, get hyphenated, which is wrong though: words with Latin prefixes usually are written together; *sub–Saharan* is written with a hyphen because *Saharan* is a proper name and therefore spelled with a capital letter.

Sometimes writers use hyphenation to express nuances in meaning. For instance, a writer might use *Arrow–Debreu model* but prefer *Bayesian Nash equilibrium* over *Bayes–Nash equilibrium* for the reason that Bayes, the person (who lived some 200 years earlier) has nothing to do with the invention of the so-called concept. Understanding the rules of hyphenation allows you to pick up on and enables you to express such differences in meaning.

### Rules based on word category and grammar

#### Age terms:

seventy-year-old factory

#### Number + noun:

two-sector growth model

### Number, ordinal + noun:

second-best frontier

### Compound modifiers:

Compounds modifiers get hyphenated. This concerns also open compounds that serve as a modifier in a new compound.

The game has one Nash equilibrium.
The game has one Nash-equilibrium outcome.

He is on tenure track.
They offered him a tenure-track position.

The equipment is up to date.
They gave him up-to-date equipment.

Figure 2 shows the game in normal form.
Figure 2 shows the normal-form representation of the game.

Rationalizability in the extensive form is due to Peace (1984).
Extensive-form rationalizability is due to Peace (1984).

The equilibrium is in pure strategies.
The game has one pure-strategy equilibrium.

### Compounds formed with prefixes:

Compounds formed with prefixes are normally closed.

antisymmetric
bidirectional
coauthor
counterclockwise
hemicontinuous
hypergeometric
macroeconomics
metalanguage
microeconomics
nonsingular
postmodern

premultiply
promarket
protolanguage
pseudoconvex
quasiconvex
quasistrict
semicontinuous
suboptimal
supermodular

However, before a capitalized word, a numeral, or a compound, the prefix is attached with a hyphen.

sub-Saharan
post-1945
non-self-sustaining

A hyphen will also go between the two words if the last letter of the prefix and the first letter of the following word are the same and in case of a double prefix.

anti-intellectual
anti-inflammatory
anti-infectious
semi-industrial
sub-subentry

### En dashes

Some publishers use en dashes instead of a hyphen when on open compound gets hyphenated.

the post–World War II years [`the post--World War II years`]
the agent–normal form [`agent--normal form`]

Or when two or several proper names make up a compound modifier.

the Arrow–Debreu model [`the Arrow--Debreu model`]

the University of Wisconsin–Madison [`the University of Wisconsin--Madison`]

Compare:

the agent–normal form [`agent--normal form`]
the agent-normal form [`agent-normal form`]

The first looks nicer and makes for better reading.

## Notebook

### Misused words

to emphasize (vb.) – the emphasis (n.)
to believe (vb.) – the belief (n.)
to lose (vb.) – loose (adj.)
major (adj.): important, serious, significant
mayor (n.): the head of a town
principle (n.): a fundamental basis of a system of thought or belief
principal (adj.): first in order of importance, main
principal (n.): most important or senior person in an organization or group

### Avoid overdetermination

| | |
|---|---|
| if the problem still persists | if the problem persists |
| throughout the entire paper | throughout the paper |
| throughout the entire interval | throughout the interval |
| a major breakthrough | a breakthrough |
| it suffices to restrict attention only to | it suffices to restrict attention to |
| does not necessarily have to be | does not have to be |
| | is not necessarily |

### Avoid unnecessary words

| | |
|---|---|
| as we will see later | as we will see |
| as I will explain later | as I will explain |
| will first [do A] before [doing B] | will [do A] first |
| | will [do A] before [doing B] |

## 4.4 Beyond grammar and usage

### Characters as subjects, actions as verbs

#### Workshop 19

- Read: Joseph M. Williams, "Clarity," chap. 1 in *Style*.
- Read the introduction of your paper. Did you find any unclear sentences? If yes, take one of those unclear sentences and rewrite it according to Williams's first two principles of clear writing: characters as subjects and their actions as verbs. Do this for another two sentences. If you cannot find any unclear sentence, or less than three, do the reverse exercise: Take a sentence that is clear and turn it into an unclear sentence by violating these two principles. (The sentence you end up with should still be grammatically correct.)

**Example**

Original Sentence:

> Prior to actual data collection, significant effort was invested into collecting business directories from various national institutions, harmonizing these directories, and verifying the entries.

Modified phrase in which characters appear as subjects and their actions as verbs:

> Before collecting the data, we have researched business directories from various national institutions, harmonized them, and verified their entries.

Discussion: Williams talks about characters and their actions. Who are the characters of economics, mathematics, or science writing? Who are the characters of Williams's text? Is it always good to use active verbs?

The passive is not always bad:

> At the same time, there will be another equilibrium in which nothing happens: nobody uses the signal and the second player does not take the desired action. But both reason-based and evolutionary stability criteria reject this equilibrium.
>
> At the same time, there will be another equilibrium in which nothing happens: the signal is never used and the second player does not take the desired action. But this equilibrium is rejected by both reason-based and evolutionary stability criteria.

## 4.5 Revising sentences

**Workshop 20**

Read: Booth, Colomb, and Williams, "Revising sentences" chap. 11 in Turabian, *A Manual for Writers of Research Papers, Theses, and Dissertations*, 109–119.

Apply their technique of focusing on the first eight words in a sentence to revise the introduction of your paper.

## 4.6 Coherence beyond the sentence

> The *intuitive criterion* (Cho and Kreps 1987) says that **player 2's belief** after a signal off the equilibrium path **should never attribute any positive probability to a type** who in the equilibrium outcome under study **gets a strictly higher payoff** than the maximum payoff that he could get from sending the off-the-equilibrium-path signal.
>
> The *intuitive criterion* (Cho and Kreps 1987) says the following: If there is a type who in the equilibrium outcome under study **gets a strictly higher payoff** than the maximum payoff that he could get from sending the off-the-equilibrium-path signal, then that **type should be discarded from the belief of player 2** after the off-the-equilibrium-path signal.

The first variant uses an active (*player 2 should never attribute*), whereas the second uses a passive (*type should be discarded*). Still, the second seems more organized:

- The second sentence follows the logical sequence of what is happening: If there is a type that is such an such, then it should be discarded. In the first sentence that order is reversed: Player 2 should never attribute any positive probability to a type that is such and such.
- The passive verb is stronger: "should be discarded" as opposed to "never a attribute a positive probability to."
- One can also mention that the second variant breaks the passage down in two sentences.

## Bits and pieces

- Repeating words is not always bad. Discuss in class: When is it good to repeat words, when not?
- Think of the reader who does not read your article from beginnig to end but reads only what is important to him or her.

## Further Readig

*The Chicago Manual of Style*, notably chapters 5 ("Grammar and usage"), 6 ("Punctuation"), and 7 ("Spelling, distinct treatment of words, and compounds").
Pinker, *The Sense of Style*, notably chapters 4 and 6.
Turabian, *A Manual for Writers of Research Papers, Theses, and Dissertations*, notably part II ("Style").
Stilman, *Grammatically Correct*.
Williams, *Style: Toward Clarity and Grace*, notably chapters 1, 2, 3, and 4.
Zinsser, *On Writing Well*, notably chapters 2, 3, 4, 6, 7, and 10.

# Chapter 5

# Writing Math

> *Mathematical notation is like musical notation; it comes to life only in the mind of the reader who can read mathematics.*

*This chapter addresses: The particularities of mathematical writing*

## 5.1 Mathematical text is hypertext

Mathematical text is hypertext; it is text on two different levels—words and mathematical formulae. As the writer of this text we have to go back and forth between these two different forms of thinking and twist them into one coherent line of reasoning—an argument. The aim of this doing is to convey an idea to the reader—a mathematical problem and its solution.

### Reading 10

- Paul R. Halmos, in Steenrod et al., *How to Write Mathematics*, 19–48.

#### Discussion

- What's Halmos's trick to make himself write?
- How does he address the unconscious of the reader? His own?

- How does he envision his audience?
- When he talks about attitudes, are there themes that are reminiscent of what we have heard from Hemingway, Auster?
- What does he mean by *writing in spirals*?
- Who is the *editorial we*?
- What does he mean by *avoiding coding and decoding*?
- What are some of the practical rules or principles that he mentions?
- What's his take on breaking rules?
- Are there points on which you disagree with him?
- Does he say things that you have thought before?
- How did you read this text? Did you underline, excerpt?

## Some Suggestions

- Do not refer to a formula before it appears in the text.

  > The replicator dynamics (7) is a system of differential equations.

  If such a sentence appears on page 3, but equation (7) appears only on page 5, the reader might wonder if he or she has missed something.

- Similarly: Do not use a symbol *that needs to be defined* before you have defined it. Suspending the definition of a symbol might be problematic even if this is done by a relative clause, namely when a page break comes in between:

  > The replicator dynamic is a system of differential equations,

  $$\dot{x}_i = x_i[f_i(x) - \bar{f}(x)],$$

> where $\bar{f}(x) = \sum_i x_i f_i(x)$ is the *average payoff* in the population.

A reader who does not know yet that $\bar{f}(x)$ refers to the average payoff in the population, at reading the formulae, might think that he or she has missed something and look for $\bar{f}(x)$ back in the text, instead of just turning the page.

- Do not start a phrase with a mathematical symbol; especially not if this symbol is a small letter.

> The second player's strategy set consists of $C$ and $D$. $A$ is a best response to $C$.

> All individuals have the same initial endowment. $j$ can be made better off if ...

Mathematics in type is different from how we talk math. Words in mathematical text not only serve the function to connect symbols and strings of thought—they also help to define the space on the page. Starting a phrase with a symbol can block the flow of the reading (the capital $A$ in the first example) or make the symbol look as if it had no proper line it belonged to (the little "j" in the second example).

> The second player's strategy consists of $C$ and $D$. Player 1's strategy $A$ is a best response to $C$.

> All individuals have the same initial endowment. Individual $j$ can be made better off if ...

When our eye meets a phrase like the one above, we do not spell out the word "individual." Our mind zips through it and goes right to $j$. We know that $j$ an individual. But it feels good that $j$ has a line it belongs to.

- When naming your characters, do not use a symbol that looks—or reads and looks—like a regular word in English.

> We run the experiment 120 rounds. $I$ was rejected 108 times.

The "$I$" in the phrase above looks, but more importantly also reads like, the pronoun for the first person singular. Though there is a difference in type, $I$ as opposed to I (in LaTeX, `$I$` as opposed to `I`), this difference is not visible enough. If nevertheless you want to use a symbol the sounds like a word, avoid semantically funny or ambiguous reading. This can be achieved, for example, by introducing an extra word.

> We run the experiment 120 rounds. Hypothesis $I$ was rejected 108 times.

- Use repetitive sentence structure to emphasize formal analogies or differences. This is particularly useful for defining concepts and stating results.

  (a) If $P_i(\omega) \subset E$ (that is, if at state $\omega$, every state that agent $i$ thinks is possible entails $E$), then we say that *agent $i$ knows $E$ at $\omega$*.

  (b) If $P_i(\omega) \subset E$ *for all* $\omega \in E$ (that is, if for *every* state $\omega \in E$, agent $i$ knows $E$), then we say that $E$ *is self evident to agent $i$*.

### Workshop 21

*At home.*

Read *A Manual for Authors of Mathematical Papers* published by the American Mathematical Society. Write in your notebook the thoughts that seem most valuable to you.

Example:

- State as concisely as possible the key contribution in your paper. Avoid lengthy summaries of known results, and minimize the preliminaries to the statements of your main results.

- Choose a title which helps the reader place the paper in the body of mathematics.
- The first paragraph of the introduction should be comprehensible to any mathematician, and it should pinpoint the location of the subject matter.
- It is sometimes useful to follow the introduction with a brief section that establishes notation and refers to standard sources for basic concepts and results. Normally this section should be less than a page in length. Some authors weave this information unobtrusively into their introductions, avoiding thereby a dull section.
- The section following the introduction should contain the statement of one or more principal results.
- The rule that the statement of a theorem should precede its proof applies equally well to the main results. It is usually poor practice to postpone the statement of a main result until a series of partial results makes its proof a triviality. A reader wants to know the objective of the paper, as well as the relevance of each section, as it is being read. In the case of a major theorem whose proof is long, its statement can be followed by an outline of the proof with reference to subsequent sections for proofs of the various parts.
- Strive for proofs that are conceptual rather than computational. [...] Decide how to state results with a minimum of symbols, and how to express the ideas of the proof without computations. Then add to this framework the details needed to clinch the results.
- Omit any computation which is routine (i.e. does not depend on unexpected tricks). Merely indicate the starting point, describe the procedure, and state the outcome.
- A part of the argument is worth isolating as a lemma if it is used at least twice later on.
- The rudiments of grammar are important.

- Strive for conceptual proofs as opposed to computational ones. This will prevent an unnecessary proliferation of special symbols, and it surely makes for easier reading.

- It is not necessary to represent symbolically each concept which appears. If a concept occurs rarely, it is usually better to refer to it by name. For example, the expression "the upper derivative on the right of $f$ at $a$" is just as clear as

$$\limsup_{x \to a+} \frac{f(x) - f(a)}{x - a},$$

  takes less space, and is much less trouble to set into type.

  The purpose of symbolism is to provide ready reference to objects so as to reveal the structure of an argument in a clear and compact fashion. If the symbols do not contribute to this purpose, use words instead.

- A short and simple mathematical expression should be left in the line of text and not displayed unless it must be numbered for later reference. *A mathematical expression whose length is nearly half a line should be displayed*; otherwise, it is likely to be broken with part on one line and part on the next and may thus be difficult to decipher. Compositors are requested, when breaking an expression, to try to do so immediately before or after an equality sign or one of the other relation symbols.

## 5.2 Symbolism and the curse of knowledge

Symbolism is helpful when it allows you to express the exact terms of a relationship that would be a pain to express in words. Still spell out the main idea in words.

> DEFINITION: If $f$ and $g$ are pure strategies for $i$, $g$ is an $ij$-replacement for $f$ if for all $l \neq j$ such that $I^{il}$ is not a successor to $I^{ij}$, $g(i,l) = f(i,l)$.
>
> This says that strategies $f$ and $g$ agree everywhere except at agent $I^{ij}$ and its successors.

Use symbolism instead of words only for short, routine expression that are known to everybody in your field. In particular, spell out the meaning of expressions that rely on symbolism that you have defined in the paper. To you it looks crystal clear and simpler than words. This is a particular form of the curse of knowledge. It looks simple and clear to you because you have invented it. A reader, though, might stumble over it and be impelled to go back to the introduction and look up the respective definition.

## Further Readig

American Mathematical Society, *A Manual For Authors of Mathematical Papers*.
American Mathematical Society, *AMS Style Guide*.
*The Chicago Manual of Style*, "Mathematics in Type," chap. 12, 579–619.
Pinker, *The Sense of Style*, notably chapter 3.
Steenrod et al., *How to Write Mathematics*.
Swanson, *Mathematics into Type*.

# Chapter 6

# Finding your own voice

*Anyway, your voice is going to be helplessly your own.*

– Jonathan Lethem in conversation with Paul Auster

*This chapter goes back to the beginning — the questions of voice, identity, and responsibility.*

**Reading 10**

- Zinsser, *On Writing Well*, "Style," 18–23.

## 6.1 Read

Find a book in English that you enjoy reading. It does not need to be a book on the subject that you are writing about. (That may even be counterproductive because it will put you too much in information-absorbing mode.) The aim of this exercise is to put you—your mind—into the rhythm of the language. What works well is a book on a subject that is in some aspect related to what you do in your work and in some other different. It can be, for instance, a biography about an economist, mathematician, or some other scientist; a popular science book; a book *about* writing; or even a novel. In

any case it should be a book that talks to you, a voice that feels as if it could be yours.

## 6.2 Imitate

**Reading 11**

- Norman Mailer, *The Spooky Art,* "Style," 74–83.

*Discussion:*

- What does he say about decisions?
- Imitation?

## 6.3 Leaving out and shining through

**Reading 12**

- Ernest Hemingway, *A Moveable Feast*, 69–77.
- Norman Mailer, *The Spooky Art,* "Living in the world," 118–120.

*Discussion:*

- What's Hemingway's theory about "leaving out"?
- What's Mailer's theory of crystals?
- How do these two theories translate to scholarly writing?

### Dare to speak in your own voice

Sometimes writing gets hard to understand when a writer has written too much with her teacher, supervisor, or some other authority over her shoulder. Such liabilities are temporary. One day you are not going to be a student any more. But your text, if there is someone who reads it, will still speak for you. This is where your responsibility as a writer comes from.

## Further reading

Mailer, *The Spooky Art*. Pinker, *The Sense of Style*, notably chapters 1 and 2. Williams, *Style*, notably Zinsser, *On Writing Well*, notably chapters 20–25.

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