

A Workshop for Writers in Economics
and related disciplines

Christina Pawlowitsch

`christina.pawlowitsch@u-paris2.fr`

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University of Vienna, PhD program in economics, Fall 2009
University of Vienna, PhD program in economics, Spring 2010
University of Vienna, PhD program in economics, Fall 2010
University of Vienna, PhD program in economics, Spring 2011
University of Vienna, PhD program in economics, Fall 2011
University of Vienna, PhD program in economics, Spring 2012
University of Vienna, Center for Doctoral Studies, Fall 2012
Vienna Business School, Doctoral School, Fall 2012
University of Vienna, Central and South-East European PhD Network, Fall 2016
University of Vienna, Central and South-East European PhD Network, Fall 2017
University of Vienna, Central and South-East European PhD Network, Fall 2018
University Panthéon-Assas, Paris II, Doctoral School, Spring 2019
University of Vienna, Central and South-East European PhD Network, Fall 2019
University North, Koprivnica, Croatia, January 2020
Institut Français de Gestion, DBA Finance, Paris, France, Spring 2020 (online)
University of Vienna, Central and South-East European PhD Network, Fall 2020 (online)
Institut Français de Gestion, DBA Finance, Paris, France, Spring 2021 (online)
University Panthéon-Assas, Paris II, Doctoral School, Spring 2021 (online)
University of Vienna, Center for Doctoral Studies, Fall 2021
Institut Français de Gestion, DBA Finance, Paris, France, Fall 2021
University of Graz, Austria, Spring 2022
Institut Français de Gestion, DBA Finance, Paris, France, Fall 2022

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

– Bram van Velde¹

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

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Preface

Different academic disciplines follow different style conventions. In economics and related disciplines, the style defined by *The Chicago Manual of Style* (published since 1906 by The University of Chicago Press) is most relevant. 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 1937 *Manual for Writers of Dissertations* from which it evolved) and *The Craft of Research* by Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams, three long-term contributors to the *Chicago Manual of Style*.

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 (notably experimental and behavioral economics); and the *The MLA Manual and Guide to Scholarly Publishing* (MLA = Modern Language Association), which is widely used in the humanities, especially modern language and literature studies.

The basis of this workbook is *Chicago style*. In addition to that, it relies on a number of other classical works on non-fiction writing, such as Strunk and White’s *The Elements of Style*, Joseph M. Williams’s *Style*, and William Zinsser’s *On Writing Well*; but also newer books, such as Roy Peter Clark’s *Writing Tools* and Steven Pinker’s *The Sense of Style*. Furthermore—and this can be considered a special feature of this workbook—there are a number of exercises that draw on what fiction writers and literary critics say about

the writing process, narration, voice, and point of view. This mostly concerns chapters 1, 2, and 6, which are the parts of the book that might be useful for writers across disciplines.

Writers in economics frequently deal with mathematical arguments. To respond to that challenge, this workbook contains a chapter on writing mathematics. The exercises proposed there are based mostly on material published by the *American Mathematical Society* (AMS), notably the *Manual for Authors of Mathematical Papers* and *How to Write Mathematics*, a collection of essays commissioned by the AMS and edited by Norman Steenrod, which contains, in particular, Paul Halmos's influential essay on the topic.

The material presented here grew out of a semester workshop that I first put together in 2009 for the PhD program in economics at the University of Vienna and that I have since then expanded and held in various forms for different programs and institutions.

Paris, January 2023

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

Workshop 1

Read:

- 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 tells us 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?

1.1. HOW TO MAKE YOURSELF WRITE: CONFIDENCE AND ROUTINE¹¹

Workshop 2

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 seem 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

Workshop 3

Read: 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 4

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 to 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 5

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.

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 the unity of pronouns? 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? Do the writer and the reader directly enter into contact with them?

For a further discussion of these three articles see my essay “Making See: A Structural Analysis of Mathematical and in particular Game-Theoretic Writing.”

Workshop 6

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?

Workshop 7

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.

- Elena Ferrante, *In the Margins*, 27 (“At this point ...”) to 34 (“... throwing me off balance.”).
- 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 are 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?
- Ferrante says: “What writing captures doesn’t pass through the sieve of a singular I solidly planted in everyday life, but is twenty people, that is, a number thrown out there to say: when I write, not even I know who I am” (p. 31). Confront this with the position that you assume when you write a research paper.
- Wood talks about *free indirect style*. Is it possible to find *free indirect style* in a research paper? Mathematical writing? (In any of the articles indicated in Workshop 3?)

1.4 Who are you writing for?

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

Workshop 8

Read: William Zinsser, “The Audience,” chap. 5 in *On Writing Well*, 24–31.

Discussion (possibly in class as group work):

- Zinsser says, “You write for yourself.” What does he mean by that? Does this make sense for academic writing? (Does it make sense for any 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?

Workshop 9

Read: Steven Pinker, “The curse of knowledge,” chap. 3 in *The Sense of Style*, 57–76.

Discussion: Guarding against the curse of knowledge, what do you need to think about in particular when writing mathematics?

[Answer: Notation!](#)

Workshop 10

At home.

Take a look at your reference list. What are the three journals that appear most often? Go to 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

Elena Ferrante, *In the Margins*.

Steven King, *On Writing*.

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 Halmos¹

This chapter addresses: the layout of a research article

2.1 Doing research

Workshop 11

At home.

Read: Booth, Colomb, and Williams, “Moving from a topic to a question to a working hypothesis,” chapter 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. Rank your questions. If you have already settled on a question

¹In the documentary *I want to be a Mathematician*.

and are in the middle of writing a paper, still, answer the *So-what?* question.

- Once you have settled on a question, outline 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 12

At home.

Read: Booth, Colomb, and Williams, “Planning a First Draft,” chapter 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 to 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

- Zinsser, “The lead and the ending,” chapter 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

Workshop 13

In class. Match students randomly in pairs. Assign one student to the role of the interviewer and the other to 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 14

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 15

In class, at the following session.

Write your abstract using not more than 250 words.

Reading

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

Discussion: What does the narrator tell us in that first paragraph of the book?

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.]

And here 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 wants to mark a break—because a new thought starts or simply because he wants to wake up the reader. Coherence is important. But that is not to say 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 later on. 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 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, think that she has missed something, which might block her in her understanding or even stop her in her reading. If you make it clear to your reader that a new thought starts, you not only help her to orient herself in the text, but 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, breathe, 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 printout. 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 grateful to you, maybe even some of those of whom you think that 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 with “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 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 Auster and Lethem’s conversation:

“Keep the process going.”

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 is about: How to organize references – when to put a reference

Workshop 16

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 style.

3.1.1 Notes and bibliography style

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: The Classic Guide to Writing Nonfiction*, 30th anniversary ed. (New York: Harper Collins, 2006), 26.

The number after the title (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: The Classic Guide to Writing Nonfiction*, 30th anniversary ed. New York: Harper Collins, 2006.

3.1.2 Author-date style

Chicago recommends this system for the physical, natural, and social sciences. Most journals in economics follow this system or a variant of it.

Text citation:

In asymmetric games, however, strict Nash equilibria *coincide* with the evolutionarily stable strategies (Selten 1980).

Reference-list entry:

Selten, Robert 1980. "A Note on Evolutionarily Stable Strategies in Asymmetric Animal Contests." *Journal of Theoretical Biology* 84: 93–101.

Here is an example of a reference list in the author-date style as recommended by *The Chicago Manual of Style*:

Aumann, Robert J. "Agreeing to Disagree." *The Annals of Statistics* 4 (6): 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, edited by Robert J. Aumann and Sergiu Hart, 281–304. 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 (1): 145–168.

For more details on both styles, with examples ranging from books over journal articles to social media content, see *The Chicago Manual of Style Online* ("Citation Quick Guide" → "Go to Notes and Bibliography Style" or → "Go to Author-Date Style") or chapters 14 and 15 of *The Chicago Manual of Style*.

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.

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.

Periods or commas?

According to Chicago Style, in a bibliographic entry appearing in a footnote or endnote, the elements of a reference (author, date, title, source) are separated by commas, whereas in a bibliography or reference list, they are separated by periods.

In both cases, the rules of American punctuation apply: commas and periods go *inside* closing quotation marks! (See the following chapter and chapter 6, “Punctuation,” in *The Chicago Manual of Style*.)

Remarks on typesetting references in L^AT_EX

- The dash between page numbers, as in 84: 93–101, is a so-called *en dash*. In L^AT_EX 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 References in APA and MLA style

Both APA and MLA style uses a variant of the author-date system.

3.4 Other 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*. 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. 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 of the periodical in which they appeared (the title of the article is suppressed). For instance:

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

3.5 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*.

3.6 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. That sounds straightforward. But there are exceptions, namely when a result has made it into the canon of a field and hence can be expected to be common knowledge between the writer and his audience. For example, in articles published in game-theory journals today, we write “Nash equilibrium,” without explicitly citing Nash (1950).

As a general guideline—and most journals in economics take that as a rule—every work cited in the text should appear in the reference list, and conversely, every work that appears in the reference list should be mentioned in the text.

Workshop 17

Go to the website 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

In the format required in the “Instructions for Preparing Articles for Publication” on the journal’s website:

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, 1431–1451.

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

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.

Here is what this list would look like in print of a paper published in the journal:

- 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. J. 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

The "Guide for Authors" on the journal's website states: "There are no strict requirements on reference formatting at submission. References can be in any style or format as long as the style is consistent. Where applicable, author(s) name(s), journal title/book title, chapter title/article title, year of publication, volume number/book chapter and the article number or pagination must be present. Use of DOI is highly encouraged."

In a paper published in *Games and Economic Behavior*, the reference list from above would look as follows:

- Aumann, R., 1976. Agreeing to disagree. *Ann. Stat.* 4, 1236–1239.
- Crawford, V., 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, P., 1993. An evolutionary model of bargaining. *J. Econ. Theory* 59, 145–168.

American Economic Review

The “Guidelines for Accepted Articles” on the journal’s website state: “References must follow the Chicago Manual of Style’s “Author-Date” style. L^AT_EX and Scientific Word users, please use the aea.bst file.” In print, the reference list of an article published in the *American Economic Review* would look as follows:

Aumann, Robert J. 1976. “Agreeing to Disagree.” *The Annals of Statistics* 4(6): 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, edited by Robert J. Aumann and Sergiu Hart, 281–304. 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(1): 145–168.

Reprint editions and modern editions

The Chicago Manual of Style states: “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 reference 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 Reading

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 microstructure of writing: words and phrases – punctuation – elements of grammar – usage

Reading

- Stephen King, *On Writing*, 114-137.

Discussion: What does Stephen King recommend every writer to have in his toolbox? What is in your toolbox?

4.1 British or American standards for rules of spelling and punctuation?

Follow either British or American standards. 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 on the journal's or publisher's website. Most, but not all, journals in the sciences, mathematics, economics, and related disciplines use American standards. 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 which standards are 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 standards as recommended by *The Chicago Manual of Style*. For British standards see, for instance, *The Oxford Style Manual*.

4.2 Punctuation

Workshop 18

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

- 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 *is* a unit of meaning. But sometimes they don’t. When we read words from a page, the rhythm and ease with which we do that are governed also by the physical aspect of the string of letters that we see 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 editors 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 mistakes 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 conducive 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 strictly quasiconcave, the individual's maximization problem will have a unique solution.

However, 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 strictly quasiconcave.

If the same actor appears as the subject in both clauses, 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 α is smaller than 0.4, it will have a unique pure-strategy Nash equilibrium.

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

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

Then, however, the relative clause (“if α is smaller than 0.4”) looks more like a parenthetical remark. A useful guideline might be 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 parenthetical 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.

In such cases, em-dashes might also work.

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”; 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 neither preceded nor followed 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 .

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

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

In the game that we have seen above, whatever the choice of α , there is always a unique Nash equilibrium.

In order to avoid putting a comma after “that,” one can use 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 .

A *nonrestrictive* relative clause, on the other hand, is both preceded and followed by a comma or some other 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.

This game has 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.)

This game has only one equilibrium, in which player 1 chooses A .

This means that the game in question has a unique equilibrium, and in this equilibrium, player 1 chooses A . If this is what is the case, it might be better to just say it that way.

This game has only one equilibrium, and in this equilibrium player 1 chooses A .

This game has a unique equilibrium, and in this equilibrium player 1 chooses A .

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 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 $(\hat{s}^{-ij}, \hat{s}^{+ij})$ 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 too, it is 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.

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).

On close reading, the sentence above is 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 19

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 of their application from your field.

Correct commands for punctuation marks in L^AT_EX

Punctuation mark	in print	in L ^A T _E X 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

- 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 20

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?

Remarks for a discussion in class:

In the examples above, the modifying element does not act on what is supposed to:

- (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 would be:
 - (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.
- (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.

Not 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 (a) with (b)* 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*? Context might provide the correct interpretation. 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, taken out of its context, we have a tendency to apply *suggested by the Commission* to *the procedures*. If *suggested by the Commission* is to be applied to the five strategies, a possible alternative might be:

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

Workshop 21

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 ε and δ .
- (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 ε and δ .

We may restrict attention to the linear approximation of F and ignore higher-order terms in ε and δ .

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 22

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 with it get deleted.

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

Anything wrong with these sentences? If yes, what?

Coordination

Original phrase

This will both impact inflation and unemployment.

This not only works in an evolutionary model but also in a model with rational players.

Payoffs can be either in terms of money or 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.

Correct phrase

This will impact both inflation and unemployment.

This works not only in an evolutionary model but also in a model with rational players.

Payoffs can be in terms of either money or emotional rewards.

Or:

Payoffs can be either in terms of money or in terms of emotional rewards.

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.

Or:

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 23*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 give 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 prepositions 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 interpret 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 the 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 avoiding 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 24*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 25***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 an 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 writing *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*).

The game has one Nash equilibrium.

The game has one 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 is 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 an 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
 throughout the entire paper
 throughout the entire interval
 a major breakthrough
 it suffices to restrict attention only to
 does not necessarily have to be

if the problem persists
 throughout the paper
 throughout the interval
 a breakthrough
 it suffices to restrict attention to
 does not have to be
 is not necessarily

Avoid unnecessary words

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

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

4.4 Beyond grammar and usage**Characters as subjects, actions as verbs****Workshop 26**

- Read: Joseph M. Williams, “Clarity,” chap. 1 in *Style*.
- Look at 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 sentences, 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 27

Read: Booth, Colomb, and Williams, "Revising sentences" chap. 11 in Tura-bian, *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 and 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 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, and when not?

- Think of the reader who does not read your article from beginning to end but reads only what is important to him or her.

Further Reading

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 interpret it.*

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

- 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 or take notes?

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 is 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 L^AT_EX, $\$I\$$ as opposed to I), this difference is not visible enough. If, nevertheless, you want to use a symbol that 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 ω , every state that agent i thinks is possible entails E), then we say that *agent i knows E at ω* .
- (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 28

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

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

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 a writer to express the exact terms of a relationship that would be a pain to be expressed in words. Still, it might help readers greatly to 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 expressions 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 Reading

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

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

6.1 On reading

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

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

Discussion:

- What does he say about decisions?
- Imitation?

6.3 Leaving out and shining through

Reading

- 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*.

Zinsser, *On Writing Well*, notably chapters 20–25.

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