

CALTECH RULES FOR WRITING PAPERS*: HOW TO STRUCTURE YOUR PAPER AND WRITE AN INTRODUCTION

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These notes provide a framework for organizing your papers. For most of you, the following format will work for most of your papers over the next few years. Although different contexts require alterations in the framework, I suggest that deviate only after you have thought through why you should deviate; that is, when you have good reason to do so. Alter or leave out some component only when you are convinced it is necessary. As with all rules of thumb, the following guidelines have useful purposes, but they should not be treated as iron laws.

Part of the point of these rules is to get you to think about the design and structure of your papers wholly apart from the arguments in them. With rare exceptions, papers do not write themselves. Transforming a good idea into a good paper is a difficult process. A clear understanding of what each part of your paper must accomplish is essential to this process.

The format that follows is appropriate for a paper that applies a theoretical idea to a particular question. Other types of papers (e.g., pure theory) require some adjustments.

The philosophy underlying this format is that papers are often their own worst enemies. Their structure and content often impede rather than aid the reader's understanding of the main point. This is especially true in circumstances where most readers (such as a referee) may not read the paper carefully.¹ Most Ph.D. students have the wrong model for writing their papers. In my experience, they typically want to imitate a great paper they have read, and often reread. Great papers typically

* I call these Caltech rules because I learned them while a graduate student at Caltech from the remarkable group of young professors: Bob Bates, John Ferejohn, Mo Fiorina, and especially Roger Noll. As they learned to articulate principles of good writing, they taught them to their graduate students. These notes represent a modest continuation of that tradition.

¹ Put another way: Thinking of your reader as a graduate student who will pore over and over your paper is a mistake. In order for your paper to get onto reading lists in courses, it must first be read by your professional peers who rarely read a paper in this manner, especially if it is from someone they have never heard. And referees for professional journals *never* read papers in this manner.

have the quality that they are clear in the contribution; more importantly, as you read and reread them, you get more out of them each time. And yet, imitating this last point is a big mistake.

The reason is that your own experience in reading them is a bad model of a reader of your own paper. Most paper in this category have already been acclaimed as great. When a reader gets yours (e.g., as a referee, a senior person in your field to whom you have sent the paper), you will be unknown. Most these readers will therefore read it quickly. A complex, intricate, or discursive argument will confuse such a reader. She is therefore likely to misunderstand your paper, lowering the chances of acceptance at a journal.

This view of the reader sets the stage for the first rule of thumb. You must design your paper so that such a reader will not be confused or lose their way or otherwise be misled. The clearer your vision of your own work and its contribution to the field, more likely your reader is to be convinced of your point. What follows represents an attempt to provide guidelines and signposts to such a reader so that she will not make basic errors in understanding what you have to say.

The first rule of all papers is therefore:

Papers must focus on one main point. Do not attempt to enrich your paper with many asides. Avoid comments that suggest implications not essential for the development of the central point. It is far better to have a narrow, focused, and useful paper than a rich one that readers find confusing and therefore ignore.

This point has two corollaries: First, every paper should be organized around a single question; and further, the paper should state that question clearly for the reader. Second, you should be able to summarize your paper in a one paragraph abstract. If you cannot do so, you are probably not clear yourself about the argument. Perhaps you think, "but my argument is too complex..." If so, you run the danger of failing to communicate to your reader.

The Structure

Part I: Introduction. From a design point of view, the introduction to a paper is one of its most important parts of a paper. A reader who is confused by the introduction – or who fails to see that the paper deals with an important or interesting issue – is not likely to read further. And, if she does read on, she is less likely to get the main point. As a consequence, every introduction should consist of four parts:

- (a) State the problem to be solved.
- (b) Discuss the state of the art (i.e., previous work) and explain why, despite/because of this literature, there remains: (i) confusion; (ii) misunderstanding; (iii) errors; or (iv) some

unresolved problem. Alternatively, present an empirical puzzle that the existing literature fails to explain.

- (c) State the essence of your contribution, that is, your solution to the problem or puzzle. Give the reader a sense of how you will solve the problem; provide some confidence that if she reads the rest of your paper, she has a chance of learning something.
- (d) The last paragraph of your introduction should always be a "road map" paragraph; for example: "This paper proceeds as follows. In section 1 ..."

Part II. Theory. Express the basic logic of your approach. This need not have any reference to the problem that motivated your study. Often short examples or illustrations are useful.

Applied papers should not develop a theory for its own sake. Rather, the purpose is to develop just as much as needed to solve the problem posed in the introduction (the actual solving takes place in the next section). As a consequence, this section should not contain *all* the implications of the approach you've derived; provide only those needed to make the main point of the paper. Even if your theory is very rich, be sparse with your asides and additional implications.

Part III. Application. This is the heart of an applied paper. Here you must show why your theory is relevant to the problem and demonstrate its analytical leverage. Put simply, this section resolves the problem stated in the introduction.

Part IV. Conclusions. State the main point of the paper. This can be in question/answer form or simply a short discussion of the problem and your answer. "In this paper, we have shown that..." Summarize for the reader what your main insight is and why you were able to do something that no one else has. You may also wish to point out some of the limitations of your argument or some of its additional implications. Of course, make sure your summary of the argument differs from that in the introduction!

Further Notes

- (1) A good test of whether you're sufficiently focused on one main point is to see whether you can summarize the paper's main argument in one paragraph. If you fail, you are probably not ready to write a cogent paper. If you succeed, not only are you ready to write the paper, but you've finished a first draft of your abstract.
- (2) Because papers that contain an "omnibus" of ideas are more complex to write, you should attempt them only with extreme caution. If you handle several themes poorly, the reader will

lose the main thread of the argument. Too many points or asides knock the reader off the track of the essential purpose of your paper. Thus, if your theory has many implications and potential applications, write several papers.

- (3) All introductions and conclusions should be self-contained. Like a several-page abstract, these should cogently present your problem, argument, and insights to the reader.
- (4) Every student should own and master Strunk and White's *The Elements of Style*. This is the single best "short course" in writing. From the standpoint of a busy graduate student, one of its principal strengths is that it does not attempt a comprehensive approach to writing. Instead, it presents a relatively small number of principles of style and a philosophy of writing that greatly facilitates learning to write.

Learn what rules you violate most frequently, and then learn how to look for these mistakes in your drafts.

- (5) Here are two related rules of thumb about writing.

(A) Jim Alt has always said to write with "clarity and conviction." If you fail to be clear, you will confuse the reader. If you fail to write with conviction — e.g., using "woulds," "coulds," "mights," and "maybes" — you will sound like you're not sure of your argument. And most readers will not waste their time reading such an argument.

(B) Dierdre McCloskey, in her *Writing of Economics* 2nd ed. MacMillan (1999,12), provides a useful aphorism you should remember: "write not merely so that the reader *can* understand but so that he cannot possibly *mis*-understand." Incidentally, this is an excellent book about social science writing, though as the title suggests, all the examples come from economics.

(6) A final rule of thumb is to write and rewrite. And then rewrite again. Every argument can be improved, and as you argue your points with your colleagues, you should revise your papers with what you've learned. George Lucas, creator of "Star Wars," once said that great films are never finished, they're just abandoned. The same point is clearly true of writing great papers. You must go over them again and again.

Exercise: Suppose your purpose was to develop a new theoretical argument, and then apply it for illustrative purposes. Unlike the emphasis in the paper described above, the purpose here is to display a new theory and convince the reader of its importance and or usefulness. How would you adjust the rules of thumb above to handle this task?