# This is Not an Article

## Just Some Thoughts on How to Write One

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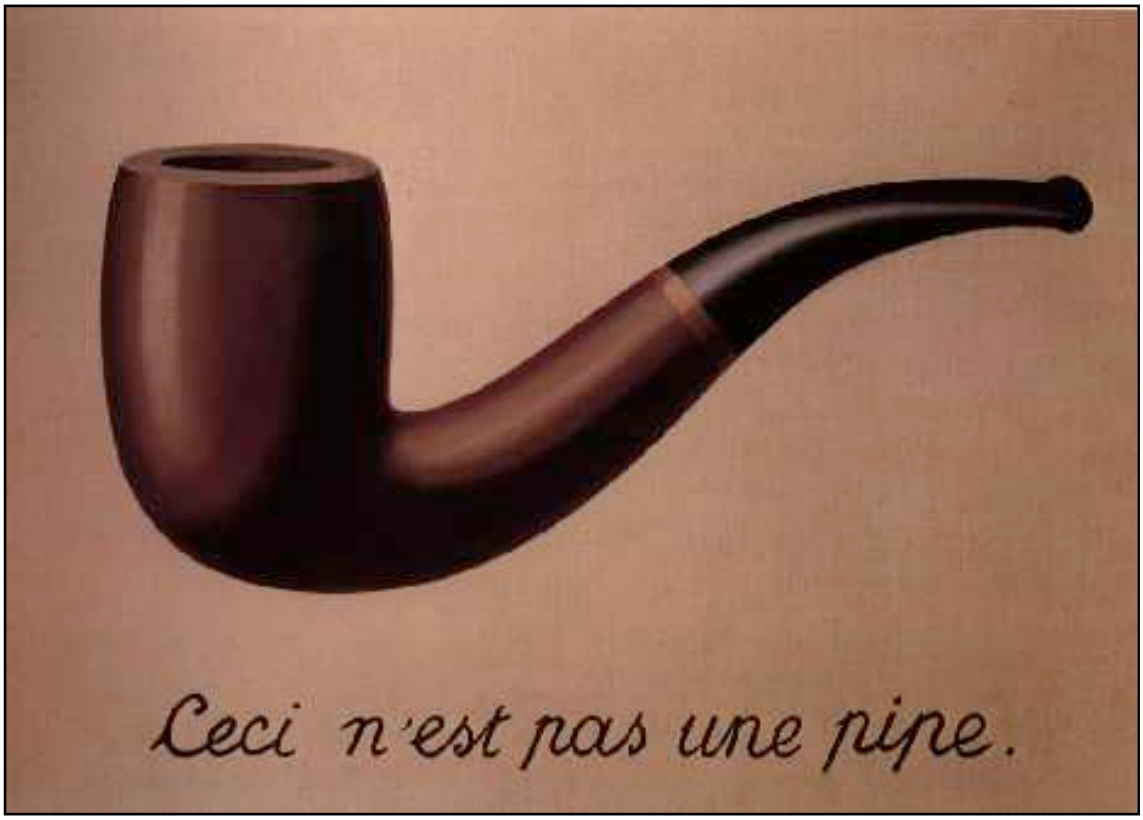


René Magritte's painting *Ceci n'est pas une pipe*, 1928, County Museum of Art, Los Angeles.

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## Abstract

When we as researchers sit in solitude, just before (or after) the final deadline for submission, and fight a hard battle in order to finish our latest, newest, and definitely, best paper to date, we do not think much about it. When we post the paper to a journal or a conference, we do not think much about it either. But I bet that most of us do when we get reviews back, or when we get nasty questions when presenting the paper at a conference. Our own colleagues are often much too polite to tell the bitter truth that the paper is flawed, unfinished, and contentious.

The following pages explores the question: How do I write a good article which both documents the body of research I have conducted, and which also "sells" the points I am trying to make? These pages contain some of the basic questions it is a good idea to have had considered before shipping the first draft off. They are based on my own subjective experiences with writing articles. It is my aim to present some of the basic rules I have learned, not the "full story". If you, when you have read these pages, try to apply the normative statements I forward in this paper, you will understand why I chose to call it *"This is Not an Article — Just Some Food for Thought on How to Write One"*.

## 1. Introduction

The stereotype of a mad scientist portrays an elderly man (mad female scientists have yet to be seen), semi-bald, wearing a white coat and small glasses, bent over an impressive set-up of test-tubes, glass-bulbs, beakers and burners, engaged in mixing colorful liquids, accompanied by disturbing sounds of chemical reactions. What he is doing might be research. On the other hand he might just be fiddling around with a lot of expensive equipment. If he is not just fiddling around, he will most likely record the results for later analysis. The experiment will also most likely be based on a set of hypotheses derived from theoretical conceptualizations and prior empirical findings. Furthermore, he will most likely document his findings in the form of technical reports, articles, presentations, books etc. This paper deals with issues pertaining to documenting research results in the form of articles.

Writing scientific articles is at times for me a difficult and cumbersome process. It is, on the other hand, also at times a very rewarding process. My own personal problems or joys are, however, relatively irrelevant. The basic functions I am supposed to provide for the salary I get are, amongst others, producing and documenting research results. Articles are one of the primary tangible results of Information Systems (IS) research. There are at least two reasons for writing articles: as an aid in reflecting upon what you are doing, and as documentation and communication of your results. This paper focuses on the latter.

The aim of this paper is to explore the question: What are the important aspects to consider when documenting Information Systems research results in scientific articles? I am not claiming that these pages can in any way replace the reading of substantial contributions on how to be a good article author. This paper is merely meant as an appetizer, and reflects my own, rather subjective, ideas on what is good craftsmanship and what is not. I, of course, also recognize that writing articles is only one amongst many ways of documenting research. Hence, this paper does not address the particular problems of writing books, technical reports, consultancy reports, field study reports, slides for oral presentations etc.

The fundamental assumption behind this paper is that when you are going to write a paper, half the job is done when you have managed to pose yourself good and essential questions to

answer in the paper. What exactly these questions are varies of course from topic to topic, but there might be a set of general questions that always need to be addressed.

Others have written about this and related topics. Robert Day (1977; 1991) has written both an article on how to write articles, as well as a very good book, which outlines important aspects of how to write a paper and subsequently get it published, plus many other relevant issues. I am not trying to compete with him or the many others listed below. This paper can be seen as the "quick and dirty" guide, or an appetizer to further studies. Beer (1992) has collected more than 60 short articles providing practical help on a number of issues from writing the first draft of a paper to giving talks. I have found a couple of papers on the topic as well: a relatively short one by Naur (1992); one containing detailed examples of how to present results by Gopen and Swan (1990); Snyder's (1991) is directed at potential submitters to OOPSLA; Pugh (1991) and Wegman (1986) focus on how to write extended abstracts. Klein (1989), Krathwohl (1988), and Witten (1990) have written on how to write proposals. Lester Sr. and Jr.'s (2004) book on how too write research papers is newer than Day's but also less entertaining. However, what it lacks in humor it makes up for in rich detail. Björk and Räisänen (2003) offer a comprehensive course in academic writing. Weston (1987) provides a very inspiring foundation for how to build a line of argumentation, and the classic by Strunk and White (1979) will teach you most of what is worth knowing about style in the English language. The Economist (2003) has produced an excellent style guide to writing, and Truss (2003) has written the very popular book on punctuation; *Eats, Shoots & Leaves*. Stephen King (2000) has written a book on the craft of writing, not in a scientific context but as authors. There is an eight-page guide on "Guide to punctuation, mechanics, and manuscript form" in (Guralnik, 1970), and Cook (1985) provides an operational and practical guide to writing. Several books offer help to aspiring writers who are engaged in doctoral work, for example books by Dunleavy (2003), Holliday (2001), and Philips & Pugh (2000). Olk & Griffith (2004) discusses how knowledge is created and disseminated among scholars. Fuller (2005) explores to great extent the difference between academics and scholars, and Frankfurt takes to the proverbial edge in his small philosophical exposition on bullshit. At MIT a bunch of computer science students has, perhaps inspired by the former, even written a generator that will automatically produce an academic paper for you (http://pdos.csail.mit.edu/scigen/).

The opinions expressed in this paper may seem a bit strong. This is mainly done in order to stress the points, and because the it is expressing my own opinions. The normative statements are meant as an ideal to strive for, an ideal which can be slightly compromised for pragmatic reasons. I, for one, have a hard time trying to live up to the principles myself. Since I only have a few years of experience in writing articles, I have certainly not learned all the tricks of the trade. All suggestions for improvement are, therefore, very welcome.

This paper is structured as a series of lessons I have learned. The next section stipulates that you need a reason to take a stand. Section 3 stresses the importance of keeping it simple. Section 4 outlines five essential questions to pose yourself when writing a paper. Section 5 suggests that you start out as a copycat, and Section 6 claims that you must earn your right to deviate from the norm Section 7 dwells on the process of writing an article. Section 8 stresses readability, and Section 9 emphasizes the relationship between writing and reviewing.

## 2. You Need a Good Excuse to Take a Stand

Before you even start on writing a paper, I must give you some good news and some bad news. The bad news is that you must earn the right to take a stand, i.e. to get a paper accepted. The good news is that committing yourself to a deadline for submission, once you actually have a good excuse for taking your stand, is a very good way of ensuring that your interesting results will be documented and reviewed by your peers. Think of articles as pieces in a big jig-saw puzzle. One of the most important aspects of research is adding and relating to an existing body of

knowledge. An article only constitutes a solid piece in this puzzle if it is reviewed by your peers and published. You, therefore, need a very good excuse to bother your busy peers with your article.

In order to provoke a little, I will just list a few archetypes on articles that I consider to be a waste of time to read (see Figure 1)[1]

The point here is that your good excuse to take a stand is either a body of theoretical or empirical work — or both. Section 4 provides some pointers as to which types of excuses you might have to take a stand.

| | |
|---|---|
| **The "great idea" paper** | "I have just had this great idea! I do not know if anyone else has ever had the same idea, because I've not checked, and I'm rather new in this field. Anyway, my idea is brilliant, so I really would like to share it with you all." |
| **The "other peoples ideas" paper** | "I have just read this great book that I really like a lot. I'll just give you a short resume of the interesting points in the book." |
| **The "software hacker" paper** | "I have just built this great computer system. It is not based on previous theories or empirical findings. I am not very theoretical myself, but the system has a lot of fantastic features, and the interface is really neat." |
| **The "theory hacker" paper** | "I have come up with this theory; conceptual framework; model. It is not related to other theories; conceptual frameworks; models, or any empirical data for that matter. Most of the concepts have been defined differently by all the big shots in the field, but I just do not like their categories so I have invented my own." |
| **The "multiple point" paper** | "I have just completed a major research effort where I did a lot of interesting things. I think that you could learn a lot by reading this paper describing all aspects of my work." |

Figure 1: Examples of archetypes of articles I do not enjoy reading.

# 3. Keep it Simple

This section deals with the simple point of keeping it simple. If you have something interesting to communicate, there is no reason whatsoever to shoot yourself in the left foot by attempting to answer too many questions in the same paper, or to shoot yourself in the right foot by bringing forward too many contentious and unsupported statements in the process of answering one question.

## Only One Point Per Paper

The "multiple points" type of paper listed in the previous section leads me to a very important point when writing a paper. The single point principle gets a section of it's own because this principle is very hard to live up to when you start writing papers. If your paper contains two or more major points, you need a very good reason not to split the paper into two or more papers, each presenting one major point. This principle is of course easier to state than to live by, and in general no rule can be provided as to when it may be broken. On the other hand, when I have reviewed an article for a journal or a conference, I am most often not in doubt when I am confronted with one that suffers from too high a density of points.

## Only Stick Your Neck into One Guillotine

When writing a paper you have the potential advantage of selecting the battleground yourself — you set the agenda to be discussed further. As mentioned above, this agenda must contain one main point or research question. Once this is taken care of, you must argue for your position. Here

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1 This list is inspired by Jonathan Liebenau's talk on the "Meet the Editors" panel session at The Joint European and American Doctoral Consortium, Copenhagen, Denmark. December 1990.

it is important that you keep the overall goal of arguing for your main point closely in mind. In order to do so in an effective manner, it is generally not a good idea to introduce marginal discussions that are not directly relevant for your position. If you have one point that you want to argue for, too many unsupported or controversial claims will inevitably weaken your position — you have stuck your neck into more than one guillotine, and this is not a particularly good idea.

# 4. Essential Questions to Ask Yourself

In the process of documenting an interesting aspect of your research in a paper, there are a multitude of questions you can ask yourself. Most of these pertain to the topic you are describing. There are, however, at least the following five general questions that it is fruitful to think about: (1) What is the problem domain? (2) What is the problem? (3) What is the research approach? (4) What have others done? and (5) What are the results?

Before we plunge deeper into these five questions, let us lighten matters up a little with an amusing example of how they have been answered in the introduction of the article “Ray Tracing Jell-O Brand Gelatin” (Heckbert, 1987) (Figure 2)

> “Ray tracing has established itself in recent years as the most general image-synthesis algorithm [10]. Researchers have investigated ray-surface intersection calculations for a number of surface primitives. These have included checkerboards [Whitted 80]; chrome balls [Whitted 80]; robot arms [Barr 82]; blue abstract things [Hanrahan 82]; more glass balls [Watterberg 83]; mandrills [Watterberg 83]; more mandrills [Sweeney 83]; green fractal hills [Kajiya 83]; more glass balls [SEDIC 83]; aquatic blobby things [Kaw 83]; more chrome balls [Heckbert 83]; pool balls [Porter 84]; more glass balls [Kajiya 86].
>
> Unfortunately, *nobody* has ray traced any food. So far, the most realistic foods were Blinn’s classic orange and strawberry images, but these were created with a scanline algorithm [2]. The *Dessert Realism Project* at Pixar is addressing this problem. This article presents new technology for ray tracing a restricted class of dessert foods, in particular Jell-O©–brand gelatin. We believe this method may have application to other brands of gelatin and, perhaps, pudding as well.
>
> This article is divided into three parts: method for modeling static Jell-O, simulation of Jell-O motion using impressive mathematics, and ray-Jell-O intersection calculations”

Figure 2: The introduction from “Ray Tracing Jell-O Brand Gelatin” (Heckbert, 1987)

The introduction above is of course meant to make the reader giggle or even laugh. It does, however, provide a compressed example of how the five questions can be answered. This section explores the five questions further, in more detail and with less humor.

## What is the Problem Domain?

In order to focus the attention of the reader, and in order to frame the research problem addressed in your paper, it is a good idea to start out by presenting the problem domain you are addressing. Let us look at the example presented in Figure 2. It starts out with the following two sentences:

> “Ray tracing has established itself in recent years as the most general image-synthesis algorithm [10]. Researchers have investigated ray-surface intersection calculations for a number of surface primitives”

By reading this, we learn that these guys are very much into ray tracing stuff. This is a characterization of the problem domain, as opposed to the statements later on in the introduction:

> "Unfortunately, *nobody* has ray traced any food. So far, the most realistic foods were Blinn's classic orange and strawberry images, but these were created with a scanline algorithm [2]. The *Dessert Realism Project* at Pixar is addressing this problem."

Now we have learned that they, in the context of this article, are into ray tracing foods. This leads us from characterizing the problem domain to characterizing the problem.

## What is the Problem?

It is very important, for your own sake, to get a clear understanding of what research question you want to address in the paper. This is important for several reasons. *First*, the clearer understanding you have, the better you are able to reach sufficient depth in your line of argument. *Second*, when the reader has read your paper they should at least associate your paper with one important point which you have argued. As a very good example, let us take Brooks's (1987) *"No Silver Bullet: Essence and Accidents of Software Engineering"* (see also Figure 4). When you have read this paper, you will associate it with the point: no software engineering technology can in itself be assumed to solve the software crisis. What a simple, but, as proved by the number of references to the paper, also powerful point. If the reader is left with a slight confusion about what the point of the paper really is, the paper will at best have little lasting effect. One of the main criteria for success in the business of writing articles is getting peers to read and quote them. If they do not remember what they have just read, chances are small that they will use the paper or recommend it to others.

## What is the Research Approach?

Here is one of the places where there is no beating around the bush. One of the factors distinguishing research from other human activities such as art, innovation, play etc. is that it is a conscious activity. This implies that it is not sufficient just to present results, you must also make yourself accountable for your actions. In some fields this means that any of your peers should be able to reproduce what you have done and obtain the same result. In many other fields this is at most only a theoretical possibility. Nonetheless, you must make yourself as accountable as possible. This can be viewed as a second-order relationship between your work and the work of others — relating your research approach to the set of possible approaches, and more closely to similar approaches applied by others. This information is very important for the reader, because it provides significant insights into exactly which types of questions he or she can possibly obtain answers to.

| | **Analytical result** | **Constructive result** |
|---|---|---|
| **Theoretical approach** | Literature survey | Theoretically based guidelines, method, framework, taxonomy, or model |
| **Empirical approach** | Case study, questionnaire survey, experiment | Empirically based guidelines, method, framework, taxonomy, or model |

Figure 3. Simple characterization of relationship between type of research approach and type of result. Adapted from (Sørensen, 1993).

Figure 3 shows an example of a simple framework you can use in order to characterize a research approach in general. It is based on two basic distinctions: on the one hand, theoretical and empirical research approaches and, on the other hand, analytical and constructive results, i.e. a distinction between descriptive and normative knowledge. These distinctions are analytical. It only adds to the strength of a paper if, for example, it argues both theoretically and empirically.

You might also contextualize your research a bit more than just characterizing type of approach and result. Here there are an abundance of sources for knowledge, so I will only mention a few. Ives, Hamilton, and Davis (1980) present a taxonomy for IS research. Wynekoop and Conger (1990) characterize CASE research by combining research purpose and approach. Dahlbom and Mathiassen (1993) provide a philosophically based framework for systems design, and conversely also a foundation for discussing research in systems design.

Once the context is in place, you must specify the research approach more closely, especially if you report an empirical study. Here there are a lot of places to go for frameworks characterizing different approaches, and I will only mention a couple of the sources, which I have found valuable. “The Information Systems Research Challenge”, Harvard Business School, divides research approaches into the three analytical categories of: (1) Experimental research (Benbasat, 1989), (2) qualitative research (Cash and Lawrence, 1989), and (3) surveys (Kraemer, 1991). Mumford *et al.* (1985) discuss research approaches in Information Systems in a number of articles.

## What Have Others Done?

As mentioned earlier in this paper, your efforts can only be characterized as research if you at some point relate your work to similar work by your peers. In some cases, this task is very easy, and in some extremely difficult. If you do work that is closely related to a body of research, it might be very easy for you to exactly state in which corner of the field you are. Here you only need to relate to the core references of the field and a couple of the works you directly build upon. In other instances, you might be on your own, in the sense that what you have done is brand new. Here must be more creative, but not in the sense that you do not have to do a proper literature search in order to determine whether or not you actually are on unbroken ground — that goes without saying. In the first, and easy case, you can be very picky regarding which work you relate to. The research you only partially share a common view with can be left out, i.e., you might not need to acknowledge close competitors. In the hard case you are forced to be more flexible about whom you associate yourself with. One of the purposes of relating your work to others work is the point of accumulating research so that “new” inventions are not invented again and again. Another, but just as important, purpose is to tune the reader into the problem setting you are exploring. When I get a new article, one of the first things I do is to scan the list of references to get a rough picture of where I am. If the only reference is to a technical report with roughly the same title as the article, I am lost.

## What are the Research Results?

Having related your research to what others have done, you are left with a tough one — to state clearly what you are contributing. Here the simple case of relating to existing research might become the hard case of stating the new and interesting results in your work. If you have broken new ground you might have an easier task. Well, when writing the paper at least. If you are way out in “left field,” to take a term from baseball, you might get problems later when trying to get your findings published. I do not address this problem in this paper. Interested readers might consult for example Kuhn (1969), who has a lot of interesting things to say about this.

### Where Should these Five Questions be Answered?

The five basic questions presented so far in this section need to be dealt with somewhere in the article, but where? In some cases it might be a good idea to devote a whole section to related research, in other cases it might be a bad idea. Some articles need an elaborate discussion of research approach, some not. I do not offer any strict guidelines for this, but as a rule of thumb, the introduction must in a short and precise line of argument, contain at least highlights of the answers.

## 5. Being a Copycat Can Pay Off

If you are in the situation of writing your first paper, the blank page, or bit-map screen, might be a little scary, even though all your research results are nicely lined up for presentation. A good strategy for getting started can be to study how others have done it. Select a couple of brilliant papers in your field and study how they are structured, how the main point is presented, how the line of argument is laid out, etc. You can learn a lot from copying the structures of abstracts and the article as a whole. When I started out, I learned a lot from copying the structure of abstract and introduction of Parnas and Clements (1986). If you do not want to copy the exact structure, you will at least have a clearer picture of what you are deviating from.

Let us examine an example of how to be a copycat and obtain a very interesting result, very different from what was copied (see Figure 4). Brooks's (1987) famous *"No Silver Bullet: Essence and Accidents of Software Engineering"* article (Brooks Jr., 1987) starts out comparing software projects to werewolves, and uses the idea of killing werewolves using silver bullets as a framing device.

The reader immediately understands Brooks's point that we should not put too much hope in a single technology acting as a silver bullet. Dahlbom & Mathiassen (1994) are not interested in stating anything regarding werewolves. They are, however, interested in capturing the reader's interest and in framing the problem they address so that no reader will be in doubt about what their point is. What do they do? They borrow Brooks's trick and replace werewolves with clocks. Figure 4 reproduces large excerpts from the introductions to Brooks's article (left column), and to Dahlbom & Mathiassen's (right column). As you can see, the basic idea of using the history of clocks and clock makers as a framing device to pinpoint the problems of what will happen to computers and computer professionals is very similar to what Brooks does in his article.

The articles "Ray Tracing Jell-O Brand Gelatin" (Heckbert, 1987) (see Figure 2), and "A Nose Gesture Interface Device: Extending Virtual Realities" (Henry et al., 1993) are both excellent and very funny paraphrases of the archetypal computer science article. They are only a couple of pages long, but manage in a very amusing way to reflect and explore a standard article format.

| *No Silver Bullet:*<br>*Essence and Accidents of Software Engineering*<br>(Brooks Jr., 1987) | *The Future of Computing*<br><br>(Dahlbom and Mathiassen, 1994) |
|---|---|
| **1. Introduction**.<br><br>Of all the monsters that fill the nightmares of our folklore, none terrify more than werewolves, because they transform unexpectedly from the familiar into horrors. For these, one seeks bullets of silver that can magically lay them to rest.<br>The familiar software project, at least as seen by the nontechnical manager, has something of this character; it is usually innocent and straightforward, but is capable of becoming a monster of missed schedules, blown budgets, and flawed products. So we hear desperate cries for a silver bullet—something to make software costs drop as rapidly as computer hardware costs do.<br>But, as we look to the horizon af a decade hence, we see no silver bullet. There is no single development, in either technology or in management technique, that by itself promises even one order-of-magnitude improvement in productivity, in reliability, in simplicity. In this article, I shall try to show why, by examinating both the nature of the software problem and the properties of the bullets proposed.<br>Skepticism is not pessimism, however. Although we see no startling break-throughs—and indeed, I believe such to be inconsistent with the nature of software—many enocuraging innovations are under way. A disciplined, consistent effort to develop, propagate, and exploit these innovations should indeed yield an order-of-magnitude improvement. There is no royal road, but there is a road. | **1. From Clocks to Our Time.**<br><br>In the fourteenth century it became high fashion for towns in Europe to invest in clockwork technology. The clocks were normally installed in church towers, to be seen all over town. They were built on the premises by clockwork makers, who usually stayed on to manage the clockwork maintenance, and in the process educate their sons in the trade.<br>[...] Being a successful technology, clocks spread throughout Europe, turning clockwork makers into a powerful and respected profession. But the success of the technology encouraged its development, and gradually the technology changed its nature. Home clocks and personal clocks (watches) were introduced and became a great success. The sheer volume of production made the craftsmen obsolete, replacing them with an industrialized production process. Decentralized, widespread use of clocks turned the town clock into more of a symbolic than a functional artifact. Clocks are now more important then ever, but the clockwork professionals have vanished.<br>The parallels between the development of clockwork technology and computer technology are obvious. What do they tell us about the future of our profession? The clockwork professionals played a leading role in developing a technology that changed dramatically the life of Europeans, and indirectly the whole world. But as professionals they did not really participate in, or appreciate, that change. When the process they instigated was running at full force, it turned them out of business. Will we go the way of the clockwork professionals? Or, will we be able to actively influence the future of our profession? |

Figure 4: Excerpts from the introductions to “No Silver Bullet: Essence and Accidents of Software Engineering” by Brooks Jr. (1987), and to “The Future of Computing” Dahlbom & Mathiassen (1994). Clearly, both articles start out with very powerful framing devices.

## 6. Earn Your Right to Deviate From the Norm

The point of earning your right to deviate from the norm relates to the form of your article. If we, in a very loose and tentative manner, apply Kuhn's (1969) concept of the normal science to the documentation of research, deviations from an established form can be viewed as attempts to change the paradigm.

The fact that scientific articles in a field are structured much alike make them easier to read and assess. When I just want to get a quick overview of an article, I read the title, abstract, conclusion, and scan the list of references. If the writer has followed the written and silent principles for how to write papers, I am quickly able to form an opinion as to whether or not the article is interesting for the research I am conducting. If the article does not sell itself well enough, for example because the results are not highlighted in the abstract or in the introduction, it is tough luck both for me and for the author. On the other hand, if the abstract and introduction, for example, oversell what actually has been obtained in the article, or if the article underneath the "wrapping" hides something else than what was announced, it is mostly tough luck for me, because I might have wasted my time reading a paper that I can not use for anything.

You can easily find very good papers which do not follow the normal structure. Just taking the two first papers, (Brooks Jr., 1987), and (Weinberg, 1982), from DeMarco and Lister's (1990) collection of their favorite software engineering articles shows that good papers do not necessarily need to follow the most common recipe. On the other hand, we are probably not all Brooks or Weinbergs in our field. If you have been around in a field for a long time, and you are a highly esteemed researcher, your peers will read your paper no matter how it is structured, based on the assumption that you presumably have something interesting to present, and that you probably will do so in an elegant and well-argued manner. The rest of us will most likely be better off relying on our research results as the main "sales argument," and present these results in a way that makes it as easy as possible for the reader to read.

## 7. How to Avoid Writing Several Articles in One

I would like to provide a few bold pointers on how to think about the process of writing an article. The process of writing is, most likely, a very personal matter. Each individual has his or her own ways of coping with this utterly excruciating activity. Personal idiosyncrasies, such as doing the dishes, mowing the lawn, jogging 20 kilometers, playing computer games, etc. etc. may be part of the process of gearing into the work. I am not trying to stipulate *the* best way to structure the process, but rather provide my opinions on the matter. So, please feel free to be provoked.

What would you think if I suggested that you started writing an article by writing a couple of sections, then working your way to thinking about the introduction and the conclusion? Just before shipping it off to a conference, read what you have written and see what title would be appropriate. In short, a bottom-up process. For obvious reasons, I do not know your answer to the question, but I will let you in on my answer which is: this is probably not a very good way to write an article. As discussed previously, one of the main qualities of an article is that it conveys one clear point. By applying a bottom-up process, you make it very hard for yourself to keep a steady course. There is a substantial danger of the result being several papers in one because of a lack of a clear criterion of relevance as to what should be included in the article and what should be left out. One of the primary characteristics of scientific articles is a relatively limited number of pages.

As you might have guessed, I advocate a top-down process to writing papers. Start out with the title. Find a really good one that reflects the main point of the paper. You might go for a humorous title, or perhaps a more sober and descriptive one. In any case, it should reflect the main point of the paper. By being careful in designing the title, you force yourself to think about which of the

infinite possible ideas for a paper you actually are going to realize. After the title is fixed, charge for the abstract. Think of it as a miniature version of the article. Use it to reflect upon the line of argumentation. Next stop, the introduction. Here, you have a bit more space to describe the article and it's context. Now you are ready to start working on the sections. Because you have forced yourself to think about which article you want to write, as opposed to all the other options, you will have a much clearer idea of what to put in the sections. In short, a scientific article should, in my view, not necessarily be viewed upon as something that emerges out of the head of the author—it is *designed*.

Well, did this provoke you? I hope so, because I really love to provoke. Fortunately, the whole matter is, of course, a bit more complicated. Any arguments you might promote against my position along the lines of "all this stuff about writing articles applying a top-down process is simply not possible because it is impossible to overlook all aspects of the line of argumentation, and I might get wiser as I write etc. etc.", are valid. I fully acknowledge that humans both cannot and will not behave in a total rational manner. Articles cannot be produced in a total rational and top-down manner — but that is no excuse for not trying! Parnas and Clements (1986) wrote an article about this in the domain of software design. They exactly start out presenting a whole set of arguments for why we never can expect to design computer-based systems in a rational manner. After which they argue for aiming at doing so anyway. The title of the paper is: "A Rational Design Process: How and Why to Fake It." Why not fake a rational process when writing papers? Aim at following a top-down process, and when you fail, you know it's OK, because it is impossible to be totally rational. If, in the middle of writing the article, you think of a better title, then change it. Do not use as an argument for not thinking of an initial the risk that it might be changed at a later stage.

## 8. Polish Packaging and Content

Let us assume that you have spent a lot of time writing a first draft of a paper. What are then the best places to put more effort in improving? Well, this is of course a highly hypothetical, and perhaps also a rather silly question to pose. My initial guess would, nonetheless, be the "packaging," i.e., title, abstract, introduction, and conclusion, in that order. One of the primary hurdles in getting people to read your paper is getting them to read the content of the paper. If the title is misleading, and if the abstract and introduction do not manage to establish the setting in an interesting way, chances are that the reader will not go any further, unless they are very devoted to the topic, appointed reviewers (in which case you are in trouble anyway), or a close friend.

The way in which you present your research results is very important. It is important to put effort into polishing the article so that it is readable. Donald Knuth's abstract to the article "The Errors of TEX" (see Figure 5) is a very good example of how in very few and well chosen words to formulate an abstract.

> "This paper is a case study of program evaluation. The author kept track of all changes made to TEX during a period of ten years, including the changes made when the original program was first debugged in 1978. The log book of these errors, numbering more than 850 items, appears as an appendix in this paper. The errors have been classified into fifteen categories for the purposes of analysis, and some of the noteworthy bugs are discussed in detail. The history of the TEX project can teach valuable lessons about the preparation of highly portable software and the maintenance of programs that aspire to high standards of reliability."

Figure 5: The abstract from "The Errors of TEX" by Knuth (1989).

When you have read it, you will probably agree with me that a suitable characterization of it is, in the words of Theodore Roosevelt “speak softly and carry a big stick.”

There are several sources to draw upon if you want to improve the style of your writing. Weston (1991) has written a very good book on how to construct a line of argument, which is highly recommended. Strunk and White’s classic *“The Elements of Style”* (Strunk Jr. and White, 1979) and *“Line By Line”* by Cook (1985) both are valuable sources of knowledge on how to write in English. The book by Day (1991) is a must for young researchers, because it provides short and precise prescriptions on how to structure articles.

If you, for example, present information graphically, it is much more likely to have an effect if it is done elegantly, instead of just randomly choosing a spread-sheet’s standard style. Presenting information graphically is, of course, a whole area in itself, and there are good and not so good ways of doing it. If you want good examples on how well it can be done, the books by Tufte are the places to look (Tufte, 1983; Tufte, 1990).

## 9. Writing and Reviewing are Two Sides of the Same Coin

There is a close relationship between writing and reviewing, as stated in the subtitle of the paper by Gopen and Swan (1990): “If the reader is to grasp what the writer means, the writer must understand what the reader needs.”

One of the distinguishing factors in the quality or status of an article is whether or not it has been subject to peer review. Research communities rely to a high degree on peer reviews as their major quality control instrument. This implies that in order for you to get your paper published, it must be reviewed by one or more of your peers. It can, therefore, be a very good idea to do a little quality control yourself on your paper before you ship it off. To the extent that the lessons learned expressed in this paper has been valuable to you so far, they can also be used to assess an article.

It is not within the scope of this paper to elaborate on the publication game: read for example the papers by Smith (1990), and Parberry (1990) for very good introductions, as well as the very interesting debate in *The Behavioral and Brain Sciences* started by the paper by Peters & Ceci (1982), which is commented in (BBS, 1982), and (BBS, 1985).

There is just a single point I would like to make, and that is: be prepared to “kill your darlings.” The paragraph or section that you’ve spent much time writing and re-writing, and maybe invested most of your pride in, need necessarily not be very communicative. You should, hence, always be prepared to “kill your darlings” if these darlings are only your own. A certain amount of stubbornness is the trademark of researchers, I have been told, and it matches my own humble experiences. However, if three reviewers all agree that certain parts of your paper stink, they might have a point. They have at least not understood what you are trying to communicate, which means that it is your problem anyway.

## Conclusion

I have in this paper tried to convey some important lessons I have learned in the process of writing articles in the field of Information Systems. These are:

- • You need a good excuse to take a stand.
- • Keep it simple by having only one point per paper, and by only sticking your neck into one guillotine.
- • Five essential questions to ask yourself
    - (1) What is the problem domain?
    - (2) What is the problem?
    - (3) What is the research approach?
    - (4) What have others done? and
    - (5) What are the results?
- • Being a copycat can pay off.
- • Earn your right to deviate from the norm.
- • Fake a top-down writing process
- • Polish packaging and content.
- • Writing and reviewing are two sides of the same coin

There is only one viable strategy for learning the craftsmanship of writing articles, and that is trial and error. It has, therefore, not been the aim of this paper to solve any of the major problems. The purpose has been, by means of my own experiences, to focus on a few simple lessons which can form the basis for further discussions and work on the topic. As a concluding remark, I would, therefore, like to encourage you as the reader to seek more information about this very important topic, in books and articles which in a more structured and thorough manner present important aspects of writing articles. It is my hope that I have sharpened your appetite, and ... may the force be with you, research is great fun and hard work! (But not always in that order).

## Exercise

Review what you just have read an evaluate how I fail to meet my own criteria for a good article.

## On-line Resources (to make it easier to avoid the library)

Strunk & White, *The Elements of Style* (full text): http://www.bartleby.com/141/
Common Errors in English: http://www.wsu.edu/~brians/errors/errors.html
A Handbook for Technical Writers: http://stipo.larc.nasa.gov/sp7084/sp7084cont.html
Grammar, Punctuation and Spelling: http://owl.english.purdue.edu/handouts/grammar/index.html
Guide to Grammar and Writing http://www.ccc.commnet.edu/grammar/
Grammar Help http://www.hut.fi/~rvilmi/help/grammar_help/
Guide to Grammar and Style http://andromeda.rutgers.edu/~jlynch/Writing/
Ranking of IS Journals http://www.bus.ucf.edu./csaunders/newjournal.htm
Ranking of IS Journals http://www.isworld.org/csaunders/rankings.htm
IS Journals http://www.cis.gsu.edu/~dstraub/Research/TargetJournalList/Target%20Journals.htm
IS Journals http://lamp.infosys.deakin.edu.au/journals/index.php

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