Communicating science: The scientific article from the 17th century to the present

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Introduction

Imagine a particular scientific article as an organism. All similar scientific articles are a part of the same species, provided that they are of the same type (i.e. a genre of a certain time, place and language with culturally defined characteristics). As that genre of scientific articles changes over time, it is evolving in response to and adapting to various social and academic pressures much as species mutate and adapt to add or subtract certain characteristics, allowing those species to fit the pressures of their new environment better. This is part of the underlying model of change that the authors use to describe 300 years of development in English, French and German scientific articles.

The author’s claim:

By examining the scientific article from its debut in the 17th century to the present, we will track the progress of an evolving genre of discourse continuously engaged in three acts: the creation of arguments for and against knowledge claims about the natural world, the artful deployment of these arguments for and against knowledge claims about the natural world, the artful deployment of these arguments in a text, and their representation in the syntax and semantics of natural languages. (vii)

Physical Layout

The 267-page book contains a 4-page preface, an introduction, 10 chapters, an epilogue, three appendices, a references section and a 5-page index. The introduction and first chapter, “Communicative and Argumentative Development Illustrated,” set out the goals of the study and provide some examples to understand the methods. The tenth chapter, “Explaining the Development of the Scientific Articles,” describes their findings, and the “Epilogue: Past, Present, Future” evaluates what the study revealed with some reflections on a theory of change,
as well as some speculations about what the future might hold for scientific articles. The middle chapters, 2 through 9, represent four pairs of articles describing the scientific article in the 17th, 18th, 19th and 20th centuries, respectively. The first chapter in each pair describes the style and presentation in the relevant century, while the second chapter in each pair describes the argumentation for the same period. The first two appendices describe the methods employed in sampling and in analyzing the texts in much more detail than in the introduction. The third appendix describes complex noun phrases that one encounters in scientific articles.

**Method: Characteristics Investigated**

The authors employ a method for comparing certain discourse features of scientific articles across the last 300 years from the scientific literature in English, French and German, grouped into the 17th, 18th, 19th and 20th centuries. They classify the characteristics they are looking for into three general areas: Style, Presentation of text and images and Argument (p. 9). They see a parallel to Aristotle’s three “areas” in rhetoric: the invention of arguments, their presentation (Aristotle’s term was *arrangement*; here it includes tables, graphics and features of format) and the style in which they are embodied (vii, viii).

It is simplifying too much to suppose that scientific articles in the past were largely anecdotal, or more person-oriented, or even rambling, as some have proposed. As the authors contend, we cannot say that scientific articles have improved, but we can say that they have changed and those changes can be described.

Late 20th century science articles have developed not only a specific type of prose, exposition and argumentation; they have also added many features that enable readers to find the information they want quickly and efficiently. Some of the characteristics of articles the authors isolated and the trends they observed over the centuries were

**Style:** **Trend:** changed to impression of objectivity

- fewer personal pronouns,
- increased use of passive voice, of dummy subjects, and of hedging expressions, and
- fewer people vs. matter / math verbs

**Style:** **Trend:** changed to greater cognitive complexity

- greater number of NPs,
- more function words between Ns and
- greater number quantifying words, equations, and other abbreviations

**Style:** **Trend:** changed to more efficient communication

- average sentence length decreased and
- finite clause to sentence ratio decreased
**Presentation: Trend:** increased communicative efficiency with master system for finding and organizing information

- titles resemble major claim,
- abstract informative / indicative,
- organization revealed in headings,
- introduction in 3 elements,
- numbered graphics or tables,
- display of equations,
- citations: how and where they are presented and
- conclusion in 3 elements

**Argument: Trend:** increased complexity in following ways

- shift from argument expression through narrative to exposition,
- increased concern for accuracy and precision by increasing hedges, and
- from arguments based on words to arguments based equally on words, tables and visuals

### Two forms of modern scientific papers

In terms of the organizational element, scientific papers have gradually taken on two forms: Form 1 is experimental, methodological or observational and Form 2 is theoretical. Although the two forms resemble each other, they are not identical, as the following table demonstrates. Note especially the elements in **bold type**.

<table>
<thead>
<tr>
<th>Elements of a modern scientific paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form 1: experimental, methodological or observational</td>
</tr>
<tr>
<td>abstract</td>
</tr>
<tr>
<td>introduction</td>
</tr>
<tr>
<td><strong>materials and methods</strong></td>
</tr>
<tr>
<td>results</td>
</tr>
<tr>
<td>discussion</td>
</tr>
<tr>
<td>conclusion (or summary)</td>
</tr>
<tr>
<td>acknowledgements</td>
</tr>
<tr>
<td>references</td>
</tr>
</tbody>
</table>

Expectations about the introductions and conclusions of scientific papers have also developed. An introduction typically contains three elements whose purposes are: establishing the intellectual territory, defining a niche in that territory and then occupying that niche (246). A conclusion also contains three elements, whose purposes correspond somewhat to those of the introduction: substantiating the original claims about having occupied the niche (and adding
insight), suggesting a wider significance to intellectual territory and making recommendations for future research to validate the claim or expand the niche (87).

**Evaluation**

This is a fascinating book to read. A few readers may want to skim the detail of the middle chapters, but a careful reading of the whole book can vastly increase our understanding of an enterprise many of us are engaged in: writing scientific linguistic articles. Most readers can benefit from understanding better their article writing (and researching, presenting and arguing). Applying the lessons of this book can help us to become much clearer about what we are trying to do as we write. For many of us who are teaching others to research languages and publish their findings, we will find the explicit elements described in the book to be a great aid in helping those new scientific writers to understand what they are doing.

The authors propose this book as a first, substantive step in a second generation of investigation into the scientific article. They have solid advice for those who want to follow on in this area of research. The methodology seems solid, and it could be adapted to come to much more solid conclusions in investigating any genre that has developed over time: personal letters, business letters, stories, etc. A fascinating similar study could be done on the development of linguistic, anthropological, socio-linguistic, literacy, language development, etc. articles over a span of time in one or more journals. It would be interesting to see if the same type of development applies to the first journals in a new research domain contrasted with the articles written in the more established, present era of research.

Another area of fruitful research could be found in extending their methodology to include some of the other characteristics that have been employed in current discourse analysis and textlinguistics. The authors isolate their research to a specific genre, and they do well at describing that genre. They describe argumentation in these scientific articles. Further tools could be applied to this area by mining research on coherence and cohesion. In the use of headings, the authors touch on segmentation (boundaries, but not much on internal unity) and prominence, but again discourse studies could suggest many more characteristics to look for in these areas. There was not much done on the progress of a mainline of development, information structure, participant reference, cohesion (narrowly defined), sub-genres, types of grammatical structures associated with different functions in the articles, macrostructure, quotation formula and cultural factors, although some suggestive comments of fruitful paths to begin these studies are offered.

So I come back to my original statement: This is a fascinating book to read. I recommend a reading and application of it to anyone writing scholarly articles or helping others who are just beginning to write. Even a partial, time-limited perusal of the book can yield results in improving one’s own writing.

**Notes**

1 *Hedging* expressions relates to expressions like “hedging your bets.” Hedging refers to limiting the scope of one’s assertions, e.g. “This proves that” vs. “This seems to support the contention that.”