Stop procrastinating! Start writing!

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As an academic for half of my career, one of my main tasks has been to edit student term papers, theses, and dissertations. Not surprisingly, such editing requires a draft document to be submitted for review. For a multitude of reasons — perfectionism, a desire to generate yet one more figure, fear of negative feedback, or discomfort with writing in a foreign language — many students procrastinate and often suffer from writer's block, where the potential author simply stares at the blank page or computer screen without making any progress. The target audience of this article includes not only graduate students and young professionals, but also, given the current industry slowdown, more seasoned professionals who haven't had the opportunity to write in years. I am assuming that the work has been completed and presented orally, and deemed by the audience, professional colleagues, or management to be worthy of publication.

Before you write: Construct every oral presentation as a potential future publication

Most papers grow out of previous oral presentations. For professionals, common sources include proprietary company project reviews, map meetings, risk-analysis assessments, and client or partner technical presentations. For students, common sources include thesis and dissertation proposals and defenses. With proper clearance from data owners, some of this work is later presented at professional society meetings. Because the vast majority of presentations at AAPG, SEG, and URTeC meetings are made in Microsoft PowerPoint, a best practice is to script your presentation in the "notes pages." The simple task of constructing such a script helps timid presenters remember what they wish to say, and it helps overly verbose presenters like me from drifting away from the target message. However, the notes pages serve two other purposes. First, you may wish to post your presentation for internal or external dissemination for those who could not attend. Second, careful notes pages are easily reformatted into figure captions for a potential future publication.

Step 1: Building the framework

Framework is different than style. In this paper, I have adopted the tutorial second-person style used in Herron's (2011) book on seismic interpretation. In contrast, the framework provides the skeleton about which you can build your paper. A key to surmounting writer's block is to be structured. *Interpretation*, and most professional journals for that matter, follows a specific framework. This framework is clearly stated in Instructions to Authors (SEG, 2016) and includes an

- Abstract
- Introduction
- Methods
- Results
- Conclusions
- References
- Acknowledgements
- Appendices, and
- List of Figure Captions.

Stewart et al. (2005) add further guidance on the purpose of each of these sections. There is considerable flexibility in the "methods" and "results" part of the paper. An algorithmic paper might be labeled "theory" and "application," a data-conditioning paper might be labeled "workflow" and "results," while a reservoir-characterization paper might have three sections — "geologic setting," "methodology," and "discussion."

To start, begin by writing down each of these headings in boldface font, as seen in every *Interpretation* paper. Now all you need to do is fill in the details. While it may seem natural to start at the beginning, most writers find the abstract to be the hardest part to write. Those who do not find this difficult often write terrible abstracts, instead writing a "summary" of what they did. My suggestion is not to dwell on the abstract until you've finished your paper. Instead, prototype your abstract with four sentences. First, define the problem in a manner that encourages a potential reader to invest the time in reading the paper. Second, state your hypothesis. Third, follow up with how you tested the hypothesis. Fourth, end your abstract by stating whether the hypothesis has been confirmed or rejected, where confirmation is most commonly achieved through calibration with field or laboratory data. It is naïve to expect your abstract to remain unchanged as you write your paper. The act of writing will clarify your original hypothesis. Sharing your first and second draft with colleagues will further refine your problem description, hypothesis, and assessment of your results. Finally, note that SEG's Publications director was a sportswriter for a

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Tulsa newspaper. Write the abstract like a sportswriter would and use active voice rather than passive voice. See Landes (1966) for an example.

At this point you have written your headings and a four-sentence abstract, and you are stuck at the introduction.

Step 2: Start with the references

Putting your reference list together is one of the most tedious components of technical writing. Fortunately, it also is one of the most mindless components of technical writing. Only include those references that you cite in the text (uncited papers belong in a "bibliography" which is not part of the *Interpretation* structure). Before you write any paper, determine your target journal for publication and use its format. Fortunately, the reference format for *Interpretation* and *Geophysics* is identical, while that for the AAPG *Bulletin* differs only in indicating the volume and pages (e.g., "Interpretation, **4**, no. 1, 14F–20F." vs. AAPG *Bulletin*, v. 4, p. 14–20.) Other journals published by SPE, AGU, and EAGE use different formats, while online searches for references result in nearly random formats. Many of my colleagues who write in multiple journals use computer software such as *EndNote* to facilitate this process. Be careful in formatting. Then read the references, which will help you write the introduction later.

Examining the November 2015 issue of *Interpretation* reveals an average paper length of 15 pages and 12 figures (Figure 1a and 1b). The average length of the references section is 1.6 pages (Figure 1c). By writing your references first, you are 11% of the way toward completing your paper. You are making progress.

Step 3: Continue with the appendices

After the references, the next easiest part of a paper to write is the appendix. Appendices should include details necessary to support your conclusions (e.g., additional core photos) or reproduce your result (algorithmic details or intermediate results of a workflow) that are not critical to following the evaluation of your hypothesis. In my view, the appendices (there can be more than one) are for the expert reader — someone working the same geologic basin or using alternative (perhaps conventional) data analysis workflows. It is perfectly permissible for the appendices to exceed the length of the main body of the paper, particularly if this makes the main body more readily accessible to the general reader. For those who are new to writing, do not feel hurt if the reviewers state that your appendices are superfluous, requesting that you simply reference someone else's published work. The main hypothesis of your work is what you want to have published. Sometimes, reviewers will request you put the appendix in the main body of your paper — an easy task. In contrast, extracting "superfluous" details from the main body of the paper requires significant restructuring. Only 17% of the papers in the November 2015 issue of *Interpretation* had an appendix. However,

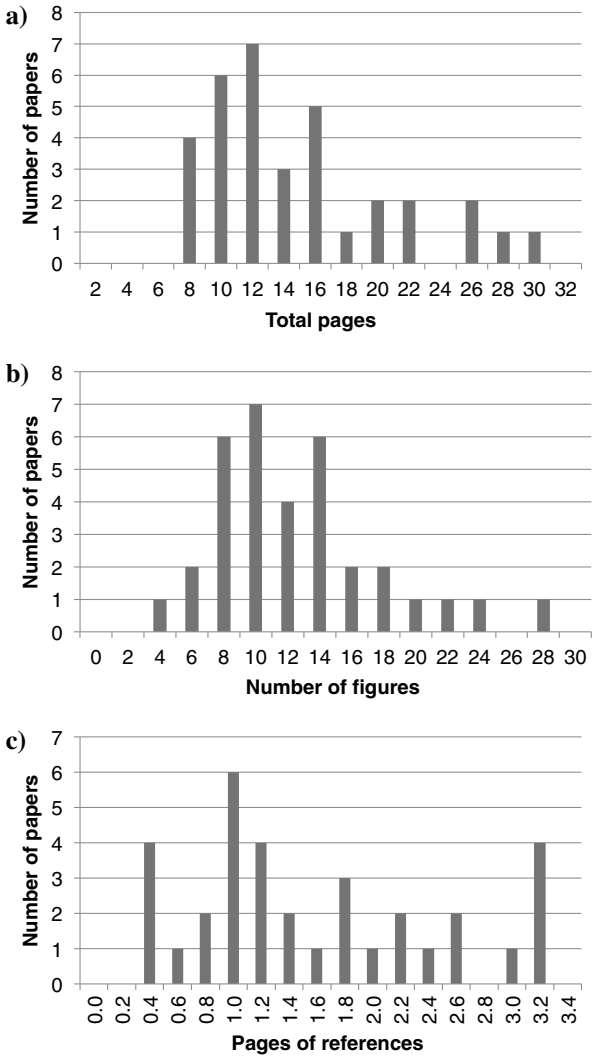

Figure 1. Bar chart of the November 2015 issue of *Interpretation*, showing histograms of (a) the total length (in pages), (b) the number of figures, and (c) the number of references (in pages) for the 36 papers in that issue.

for those that did, the average length was 2.9 pages or 18% of those papers. Using the statistics for the November 2015 issue, these writers would have 29% of their papers written.

Step 4: Follow up with a first draft of the methods, results, and list of figure captions

Because you are the expert in the topic to be published, the next easiest parts to write are the *methods* and *results*. These parts of your paper should follow the structure of your previous oral presentation. First, convert your PowerPoint notes pages into a more formal list of figure captions. Most readers look at the figures before reading any other part of the paper. For this reason, I believe that the figures and figure captions should be able to "stand alone" and give the casual reader an understanding of the objective, methods used, and results of the paper. If enticed by attractive figures, some

of these casual readers will invest the time to read your paper. Refer to your four-sentence abstract and choose those figures that define the problem, define the hypothesis, describe the methodology, and summarize the results. Then start stringing the figures together as you would your oral presentation. As you write, you will find there will be one or more key figures that are missing. Write the figure captions to these missing figures and then continue writing. Don't stop. Remember, you want to keep up the momentum and avoid writer's block. At the end, you should have a paper that flows quite well but is missing key figures. Now you are at the 75% mark.

Step 5: Put a colleague in the acknowledgments and then ask him or her for a first review

You need one or more colleagues to review your paper several times before you submit it for publication. One of these colleagues should represent a general reader of *Interpretation* and another someone proficient in your area of expertise. Both will be able to see flaws in logic and suggest improvements in both written arguments and supporting figures. If they agree to review your paper, put them in the acknowledgements section before you hand them your draft (as I have done for this article). While some will ask you to not put their name down, most will feel invested in helping you achieve your goal. If English is not your native language, use a commercial grammar-checking software package (e.g., Microsoft Grammar Check, Grammarly, and Pro Writing Aid). Change the default options to flag the use of passive voice. Read the article by Sylvester and Costa (1989) and check for commonly misused geologic terms. Then ask for help from a native English speaker colleague or a colleague who routinely publishes or writes reports for clients or partners in English.

Step 6: Review your references and write the introduction

After the abstract, the introduction is the hardest part of a technical paper to write for less-experienced writers. The introduction requires considerable perspective on what the problem is and the body of work that has preceded your effort. Be sure to do a complete literature review as you compile your references. The more papers you write in a given area, the easier it is to write the introduction. Avoid omitting important references or, worse yet, degrading references to competing methods and alternative interpretations. These authors may be your reviewers.

The key to avoiding writer's block is to define a framework and fill it in. I follow the framework defined by Claerbout (1995) in which the last paragraph of the introduction summarizes each of the following sections in a sentence or phrase.

Step 7: Summarize your findings and write your conclusions

The final step is to write the conclusions. *Interpretation* Instructions to Authors (SEG, 2016) states that the "conclusions section should include (1) principles, relations, and generalizations inferred from the results (but not a restatement or summary of the results); (2) any exceptions to or problems with those principles, relations, and generalizations as indicated by the results; (3) agreements or disagreements with previously published work; and (4) implications and significance of the work." In my experience, it is better to explicitly identify the limitations of your analysis rather than have the readers find them, with the risk that they will reject the entirety of your work. Don't leave loose ends.

Final touches

At this point, return to your abstract and modify it to align it with the current version of your paper. Then give this version of the document (missing the key figures) to your colleagues to review and edit. You still have figures to generate and revisions to make — a lot of work — but you now have a complete paper in front of you.

The current issue

The February 2016 issue contains 34 papers. In addition to seven papers in the general *Technical papers* section, it features the following special sections:

- *Exploration and characterization of gas hydrates*; editors: Ray Boswell, Tim Collett, Matthew Frye, Stefan Buenz, Ingo Pecher, Thomas Reichel, Dan McConnell, Jurgen Mienert, Tetsuya Fujii, Byong Jae Ryu, Kook-Sun Shin, and Dianna Shelander; eight papers published.
- *Seismic attributes*; editors: Oswaldo Cataldo, Marcilio Matos, Matthijs van der Molen, Victor Aarre, Donatella Astratti, Saleh al-Dossary, Stephen Kellogg, Luis Alberto Vernengo, and Kurt Marfurt; 11 papers published.
- *The Gulf of Mexico: Regional studies, play concepts, recent developments, and case histories*; editors: Donald Herron, John Snedden, Samuel Mentemeier, Neil Evans, and Karen Tindale; eight papers published.

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