Writing a Scientific Journal Paper: Preparation through Publication

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Introduction

Successful publication of your GIScience research in a peer-reviewed scientific journal such as *Photogrammetric Engineering & Remote Sensing* may be one of the most important things you do in your career. However, the publication process is not for the faint of heart. There are many steps that must be taken into consideration before your paper can be published. It is naïve to think that most of the work has been completed when you finish writing the initial draft of your paper. In fact, the work has just begun. In order to be a successful author, you must understand all the components that go into having your paper published, including adequate preparation, high-quality writing, proper submission, and appropriate revision. This paper will provide you with an overview of the steps and many issues to consider when submitting and revising your work for publication as a peer-reviewed paper.

Writing the Paper

There are a number of important issues to consider as you begin the process of writing a scientific, peer-reviewed, journal paper. First, before you even begin writing, you should consider and carefully select the appropriate journal for your paper. Second, you must understand the various components of a scientific paper and avoid the common pitfalls that many novice authors encounter. Finally, there are other considerations, including: co-authors, professional e

Which Journal?

The selection of the appropriate journal is one of the most important decisions made in the publication process. Not all journals are the same even though they publish papers on similar topics. For example, some journals publish mainly theoretical papers rather than applied science. Some journals prefer very brief papers (e.g., less than 3 pages) while others publish longer papers (although the author(s) may incur page charges). Some journals have moderate review standards, while other journals, such as *Photogrammetric Engineering & Remote Sensing*, have very rigorous review standards. It is very important that you evaluate your topic and select a journal that is appropriate for the scope and caliber of the paper you are writing. Failure to submit your paper to the most appropriate journal can lead to frustration and difficulty in having your paper published or losing the deserved popularity and recognition of your work.

Once an appropriate journal has been selected, it is important that you become familiar with that journal. Read a number of papers, especially those that cover topics that are similar to your research results. Note the style and organization of the published papers. Observe how references are cited. Review the standard format for abstracts and concluding remarks. The more you understand about journal content and format, the easier it will be for you to create a paper that has a higher probability of publication in the journal.

Components of a Scientific Paper

A scientific paper is not written like a magazine, a newspaper article, or a novel. Scientific papers are unique and must be written in a special way. One of the best ways to become proficient at writing scientific papers is to read a lot of them. The more scientific papers you read, the easier it will be to determine the good papers from the bad papers. The well-constructed papers have certain components that are common to all scientific papers, including: an abstract, introduction, hypothesis/objectives, methods, results, conclusions, and references.

The abstract is a key component of the paper. Even many experienced authors have trouble writ ing a good abstract. The abstract is usually limited to 150-300 words yet must provide a complete synopsis of your paper including the problem being solved, the approach to the problem, the major finding(s) including quantitative results, and the conclusions. A good abstract causes the reader to want to read the rest of the paper. Many abstracts lack sufficient results and conclusions and spend too much time describing the nature of the problem.

The introduction sets the tone for the entire paper. It must provide a clear description of the problem along with its significance (i.e., why the topic is important). The introduction also contains a short review of the relevant literature on the subject and points out any limitations or shortcomings. Most importantly, it identifies where you intend to make an important contribution to the state-of-the-art.

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The introduction then provides the reader with an abbreviated version of the potential solution(s) to the problem that you stated earlier. Finally, the introduction provides a structure or road map for the rest of the paper.

Immediately following the introduction are the objectives and hypotheses to be tested. The study area and its characteristics are often included in this section. The methods are then described which provide the reader with information about how you accomplished the objectives or tested the hypotheses. It is not uncommon to provide detailed scientific citations in the methods section. Commonly used methods do not need to be explained in detail. However, new and/or improved methods or techniques need to be described in detail, clearly and concisely. The results section of the paper contains just the results and typically includes supporting maps, images, tables, and figures. It is important to be logical and objective here. The results are not the place for concluding remarks. Figure and table captions are especially important and must adequately explain the content found within each figure or caption. If the author is not the source of the information in a figure or table, then a very carefully crafted source statement should be included in the caption (e.g., Source: Author(s), 2011, "paper title", U.S. Geological Survey Professional Paper ##, p. ##). All graphics must be complete with properly labeled axes, legends, and/or scale bars, and other explanatory notes. Many authors have problems creating high-quality graphics that adequately convey the results of their research. An important consideration here is color. Almost all hardcopy journals charge for color (on-line journals usually do not charge for color). Some figures must be displayed in color in order to adequately communicate the results. However, many figures can be created using gray-scale shading and/or hatching and other techniques to adequately communicate the information. If color is absolutely necessary to communicate the results, then carefully consider the journal's color policies and cost considerations.

The conclusions section of the paper should discuss the results of your research and present the supported implications of your work. This section contains the interpretation of your results. It is important to only discuss conclusions that your research results support. You should not speculate on related topics or concerns not supported by your findings. The conclusions should be as strong or powerful as your results warrant. They should not be overstated. Finally, any future work that logically follows from the work presented in your paper can be mentioned at the end of the conclusions section.

The remaining sections of the paper include the references or literature cited, acknowledgements, and appendices. All scientific papers have a references or literature cited section that contains the bibliographic citations for each paper that was referenced in your paper. Most journals provide a detailed scientific citation style and a format for the reference section. These instructions should be carefully followed. It is also common to have an acknowledgements section in your paper. This section recognizes those that may have helped with the paper but not to the level that they would become co-authors. Funding sources and data providers are often acknowledged. Some papers contain appendices. An appendix is usually a short explanation of some portion of the paper that is not so important as to be in the body of the paper, but important enough to require inclusion at the end of the paper. Mathematical/statistical derivations are often placed in appendices.

There are a number of helpful hints to remember when preparing to write your paper and even while writing it. The paper should follow the 4C rule and be Correct, Clear, Consistent, and Concise. In order for your paper to be accepted it must:

- **Have a well-defined objective**
- **Be self-contained**
- **Be understandable**
- **Be informative**
- **Add to our understanding of the state-of-the-art**

There are some common pitfalls that many authors fall into that should be avoided. These include:

- **Lack of structure – missing headings/subheadings or transitional statements between sections, paragraphs, or other elements in the paper**
- **Lack of detail – incomplete data description, missing information, bad graphics**
- **Lack of clarity – poor explanations, inconsistent word choices**
- **Lack of logic – insufficient testing, unable to convincingly explain results, contradictory statements**
- **Lack of understanding – shallow or superficial discussion, poor interpretation of results**
- **Lack of objectiveness – biased design or interpretation of results, subjective discussion**

Finally, there are some tips that can help while writing a paper and even after it is written. During the writing it is important to have a clear, well-defined objective. If you do not know your objectives, you can be assured that your readers will struggle as well. Write down the questions that the paper will answer and review them often. Write the body of the paper (objectives, methods, results, and conclusions) first and write the introduction and the abstract last. Be clear, logical, and consistent (especially with notation, variables, etc.). Be concise. The fewer words the better. Use the active voice and avoid long, complex sentences.

Once you have written the paper, take a break. Put the paper aside for a week or two. When you read it again, read it as if you were an unbiased reviewer. Check to see if your paper is logical and that the conclusions are sound. Once you have revised it, read it again and repeat this process. Finally, review the paper one more time, line by line, making sure you have followed all of the journal format specifications associated with the organization, text, tables, figures, and references.

Other Factors

There are a few last factors that must be considered when planning and writing a paper. These factors include: co-authors, professional ethics, and internal review. A paper has a lead author who is also usually the corresponding author who writes most of the paper and is responsible for submitting it for publication. A paper can also have co-authors. These individuals have helped with some significant part of the research and have been involved in the writing. Typically, someone who simply reviews the paper or provides minor help on some part of the paper is not included

as a co-author. It is important to establish who is and who is not going to be an author on the paper as early as possible in the publication process. In this way, contributions are reviewed and authorship or co-authorship is clearly defined. Failure to do this can create serious problems and unhappy colleagues.

Professional ethics are a very important part of paper writing. One should be proud of his or her work and take credit for it. However, one must also be careful to give credit to other people's work. Plagiarism is a very big problem in scientific writing today. It is easy to cut and paste someone else's idea or explanation of a concept, word-for-word. Such copying is not appropriate. If you copy a passage exactly from another published source, it must be placed in "quotes" and carefully referenced. Sometimes you can summarize the concept in your own words and then cite the source of the idea, but you cannot simply copy it. It is appropriate to carefully cite your previously published research in peer-reviewed papers. This is called self-citation. However, self-citation should not be at the exclusion of others who have also made substantive contributions to the research area. Also, self-plagiarism is as wrong as plagiarism. If you include text, algorithms, figures, etc. from one of your previously published papers, you must carefully reference these materials. Papers that are found to contain plagiarized or self-plagiarized materials are rejected by the Editor and not re-considered for publication.

A paper must be submitted to one and only one journal at a time. It is unethical to send your paper to two or more journals simultaneously hoping that your paper will be accepted for publication in one of them. Most journals now require some statement to the effect that "this paper is original work and has not been submitted elsewhere for publication". However, all too often reviewers report seeing the same or a very similar paper submitted or published in multiple journals.

Finally, after you have written your paper, set it aside for a short time, reviewed and revised it, and checked it for formatting and style, then you are ready to get an internal review of your paper. Ask a few colleagues at your college/university or place of employment to read your paper. See if they can tell you about the main issue your paper addresses. See if they can tell you the significance of your work. See if they can understand the content in figures and tables and the messages you are trying to communicate through these figures or tables. It is much better to get feedback from those around you than to get negative comments from external reviewers that can jeopardize publication of the paper. Consider the comments received and revise the paper again. Then your paper is almost ready for submission to the journal.

The well-constructed papers have certain components that are common to all scientific papers, including: an abstract, introduction, hypothesis/ objectives, methods, results, conclusions, and references.

Submitting the Paper

Once the paper has been written, there are a few final steps that must be taken before submitting it to a journal. These steps include: checking to make sure you meet the journal guidelines, writing a letter to the editor, and understanding the submission process.

Meeting the Journal Guidelines

As discussed earlier, every paper should be written with a specific journal in mind. Check the guidelines for that journal and make sure that your paper meets all the formats, styles, and other instructions. Carefully following the journal instructions shows respect and courtesy. Submitting a paper that is not properly formatted for a given journal creates considerable problems for the Editor. If you have not followed the specifications, your paper will simply be returned to you and you will have earned the ire of the Editor. There are many parts of your paper that need checking. Here are just a few questions that you should ask yourself:

- What format should the paper be in? (Word, PDF, etc.)
- How are equations handled?
- What format is used for citations and references?
- How long can my paper be?
- Are there page charges?
- Are there charges for color?
- How many words can the abstract be?
- How are tables and figures submitted?
- Do I need page numbers?
- Do I need line numbers?
- How many words can my title be?
- Is the review process blind or double-blind?

Most of these questions are self-explanatory. However, the question about the review process needs a little further explanation. Some journals use a blind review process in which the reviewers know who the author of the paper is but the author does not know the reviewers. Some journals use a double-blind process in which both the reviewers and authors remain unknown. If you are submitting a paper to a journal that uses a double-blind process, it is important that any author information including acknowledgements be removed from the paper when it is submitted. Otherwise, the identity of the authors may be revealed. It should be clear at this point that the more the author knows about the journal, the more effectively and efficiently the author can prepare a high-quality paper.

Letter to the Editor

A letter to the Editor (often called a cover letter) is written and submitted with the paper to the journal. This letter should be professional and courteous and is written by the "corresponding author". The corresponding author is often the first author; however, this is not mandatory. Sometimes there are good reasons why one of the co-authors is the corresponding author. The cover letter should contain all the required information as stated in the instructions. For example, the full names, addresses, and email addresses of all the authors and co-authors is often required in the cover letter. Also, as mentioned previously, a statement about this paper being original work and not submitted to any other journal may also be required. The letter to the Editor is the corresponding author's chance to demonstrate to the Edi-

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tor that he or she is familiar with this journal and has carefully read the journal instructions. Authors that write poor cover letters show a lack of initiative which reflects poorly on the author.

An Overview of the Submission Process

Once the paper has been properly prepared and formatted for a specific journal and an appropriate cover letter to the editor has been composed, then the paper is ready for submission. Almost all of the communication between the corresponding author and Editor will be through electronic means. Therefore, it is important to carefully keep track of this communication. An author will receive confirmation from the Editor that the paper was received in readable condition. Papers are usually assigned a specific number (e.g., #2011-017) associated with the submission. If the corresponding author does not receive a confirmation within a few days to a week of submitting the paper, they should contact the Editor to make sure the paper was not lost. The review process itself will take several months depending on the journal. The author should be patient and not pester the Editor for the reviews before the time specified. Good Editors will communicate effectively with authors so that everyone feels comfortable with the process. Details about the review process are presented in the following sections.

The Paper Review Process

This section describes the paper review process. It is wise for an author(s) submitting a paper to a peer-reviewed journal to understand the review process, how to respond to reviewer comments, and how to craft and transmit a revised paper to the Editor for publication.

Human Nature and the Paper Revision Process

It is human nature to avoid criticism of one's work. In fact, most GIScientists consider themselves experts in the field and don't appreciate criticism of their experimental design, data collection, data analysis, or results. In addition, many reviewers request changes in English grammar and paper organization. Therefore, author(s) must be willing to accept constructive criticism and commit themselves to addressing the reviewer comments and preparing an improved paper. The paper review process can be a humbling experience for new and even senior GIScientists, but hopefully the author(s) will learn something of value during the review process that results in an improved, high-quality peer-reviewed publication.

Paper Reviewers

The Editor of the journal supervises the peer-review of the paper. As the word "peer" implies, the paper is typically sent to three (3) "peers" who understand the subject matter well. In fact, in many instances, the peers may actually know more about the subject matter than the submitting author(s). Peer-reviewers are usually preeminent scientists in the field and have the ability to determine if the research presented is new and makes a significant contribution.

A quality peer-review usually takes the reviewer about three hours: two hours to read the paper and one hour to carefully craft the review comments. In addition, some reviewers like to annotate comments directly onto the digital version of the paper (e.g., using "track changes") and allow the Editor to transmit the "annotated paper" to the author(s).

The paper should follow the 4C rule and be Correct, Clear, Consistent, and Concise.

Peer-reviewers typically want to remain anonymous, especially when serious logic or methodological flaws are discovered in the paper. On the other hand, a few reviewers allow the Editor to share their identity with the author(s). The author(s) then have the opportunity to correspond directly with the reviewer to better understand how to address important criticisms or recommendations.

Timeliness of the Paper Review

The amount of time it takes to have the paper reviewed varies by journal and should be taken into consideration by the author(s). Most papers are now submitted over the Internet and all communication about the paper takes place over the Internet. This speeds up the review process. Nevertheless, the review of a scientific peer-reviewed paper still typically seems to take from one to three months. Every journal has a real or perceived reputation as to how long it takes to have a paper reviewed (e.g., one month, three months). The author(s) should take this into consideration, especially when the author(s) are in academic tenure-track positions where it is important to have their scientific research published as soon as possible.

It is important that the author(s) be patient and not constantly contact the Editor about the status of their paper. Enquiries about the review status should probably only occur after three months have elapsed. Constant email or phone badgering of the Editor serves no useful purpose as the Editor is very aware of the status of the review and is doing everything he or she can do to provide a timely review. It is important to remember that reviewers are not compensated for their reviews. All of their review effort is performed as a personal service to the author(s) and the pr

Transmittal of the Review Comments

After a few weeks or months, the Editor receives the review(s) of the paper. Most Editors prefer to have at least two reviews in hand before transmitting the review comments to the author(s). Thus, tardy reviewers can slow down the review process considerably as the Editor must then gently persuade the tardy reviewer(s) to perform the review as soon as possible

The author(s) usually receives the reviewer comments via email from the Editor. The beginning paragraph of the transmittal usually includes a summary statement from the Editor providing the author(s) with instructions on how to proceed, including:

1. The paper is **rejected** based on the some stated grounds and will not be considered further; or

2. The paper requires no revision and is **accepted** for publication by the Editor. (This happens occasionally for truly exceptional papers); or
3. The paper review includes **non-mandatory revision** comments that should be considered before resubmission. The author(s) are given the opportunity to decide whether or not to incorporate the non-mandatory suggestions; or
5. The paper requires **mandatory revision** based on the review comments before resubmission. Mandatory revision papers are typically re-reviewed by at least one of the original reviewers and perhaps the Editor.

Anonymous detailed comments from reviewers #1, #2, and/or #3 and any "annotated papers" are provided to the author(s). The author(s) evaluate these reviews and "annotated paper" comments.

Potential Responses to the Reviewer Comments

After carefully considering the review comments, the author(s) must decide how to proceed. There are two typical responses, one appropriate and one inappropriate. The inappropriate response is that the author(s) finds the review comments totally unacceptable and vows never to submit any more of their research to this journal. The author(s) does not resubmit the paper and doesn't have the courtesy to let the Editor know that he/she is upset and that he/she will not be providing a revised paper. This is not good practice and may make the Editor hesitant when considering future paper submissions from this author(s).

The appropriate response is a brief note to the Editor stating what the author(s) intends to do. There are two typical responses: 1) the author(s) plans on efficiently addressing the review comments and submitting a high-quality revised paper for consideration and publication as soon as possible, or 2) the author(s) finds the review comments difficult to address in a short period of time, therefore the/she will need a few extra months to address the mandatory comments. Editors appreciate knowing how the author(s) intends to proceed as it helps them plan for future issue content. Editors are usually understanding and sensitive to these circumstances.

Who Responds to the Review Comments?

The primary or corresponding author should transmit the Editor's summary statement, reviewer #1, #2, and #3 comments, and any "annotated papers" to all of the co-authors. After consultation with the co-authors and additional work on the paper, the primary author collates the required revisions and creates the revised paper that is transmitted back to the Editor. The primary author should be the single voice that speaks on behalf of the paper for all of the co-authors.

The Nature of Review Comments

Be professional and don't be upset about receiving some negative review comments. Most papers can be improved by taking into consideration quality reviewer comments. Please keep in mind that reviews can be:

1. **Very useful** and carefully crafted by a highly-skilled GIScience professional. The reviewer usually has a genuine interest in helping the author(s) prepare a logical, accurate, and well-written paper for publication.
2. **Moderately useful** with minimal input from the reviewer. The reviewer may provide general comments or suggestions which are often difficult to address or implement. Usually the reviewer has put only minimal time and effort into the paper review.
3. **Poor**, or very negative wherein the reviewer a) doesn't like other people working in his or her area of expertise, b) considers most other research as inferior to his or her own research and is very condescend ing, and/or c) simply didn't have time to do a good job reviewing the paper and provides an inappropriate negative review.

If the author(s) believes that a review comment is inappropriate or incorrect, they should consider using the following type of constructive language in their response to the Editor:

> "Reviewer #1 says that algorithm ____ or concept _____ is in error on page 6, line 10. We respectfully suggest that this reviewer missed the point about concept____. It appears that the reviewer did not understand ____ and _____. Nevertheless, we have changed the second paragraph on page 6 to include additional information on this topic to make the concept clear."

Submitting the Revised Paper

A formal "Letter of Transmittal" and a "Revised Paper" are sent to the Editor after all of the review comments have been addressed. The Letter of Transmittal accompanying the revised paper is very important and should not be too brief. It should describe how the review comments were handled. In particular, most Editors like the author(s) to say in the transmittal letter: "We addressed every one of the reviewer comments. Below please find an itemized list of all of the reviewer comments and detailed information about how each of the reviewer comments was addressed in the text, tables, figures, and/or captions."

Along with the letter of transmittal, the author(s) should provide a Revised Paper with all corrections in place. Some authors like to highlight all of the changes in yellow or some other color so that the Editor or re-reviewer(s) can easily identify where corrections have been made.

The Paper is Accepted for Publication

Hopefully, the Editor determines that the author(s) has addressed all of the substantive review comments and produced a high-quality research paper that is worthy of publication. The Editor communicates with the corresponding author that the paper has been accepted for publication. Congratulations! The Editor then instructs the journal Production/Technical Editor to have the revised paper type-set. Page proofs of the paper are sent to the corresponding author. Also, at this time all page and color charges must be paid for and copyright forms submitted. Only significant type-setting errors are changed at this late date in the publication process. The type-set paper is then placed in the queue awaiting publication. This may take some time depending upon the number of regular papers in the queue and special issues to be published.

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Concluding Remarks

One good way to gain knowledge about what constitutes a high-quality scientific research paper is to volunteer to be a paper reviewer yourself. There is an ever-growing need for rigorous and efficient reviewers. A good guideline is to remember that at least three reviewers are needed for every paper. Therefore, you should be willing to review three papers for every one that you submit for publication. Then, please treat the author as you would like to be treated and return your constructive review to the Editor in a timely manner.

Successful publication in peer-reviewed journals such as *Photogrammetric Engineering & Remote Sensing* requires rigorous scientific research, thoughtful writing, preparation of the paper in the proper format, careful attention to reviewer comments, and perseverance. The result can be a quality scientific paper that has a significant impact on the state-of-the-art.

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ASPRS Films Committee Seeking Volunteers with Experience In Video Production

The ASPRS Films Committee is seeking ASPRS members with experience in film/video production as volunteers to assist the committee with creation of our videos. Our need is for someone who can assist the committee, on a volunteer basis, in developing the themes and narratives for our projects, and coordinating production of videos with the committee and the videographers, editors, and others who collaborate to prepare our videos. The committee meets by telecon at least once a month and usually uses ASPRS meetings as venues for conducting interviews, informing the ASPRS membership of our activities, and meeting with our members.

See **http://www.asprs.org/films/index.html**.

Some of our videos can be viewed at **http://www.youtube.com/watch?v=GXS0bsR0e7w**, and at **http://www.asprs.org/films/films.html**

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