Guideline for Peer-Review
AeroSpaceArchitecture Design Research Papers

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The purpose of Peer Review Publication is to establish a quality control mechanism that in effect certifies the scholarly or scientific quality of a technical paper. It supports the fundamental purpose of research: to create new knowledge by making it available in a reliable form. It is not intended primarily to prevent scientific or academic fraud, although it may have a deterrent effect in that regard. Rather, the intent is to avoid honest error -- to establish that the information or data in the paper is logical, internally consistent, and valid within the scope of the presentation.

Peer Review elevates a paper above the standard conference paper that at most requires a review of the abstract and (sometimes) approval by the author's home organization. It is not intended as a marketing opportunity, although if an author produces a paper that passes peer review, it may help make the case to potential clients. In the immortal words of the Society of Automotive Engineers publications division "Authors should avoid self-promotion and puffery."

There are many different approaches to Design Research in Architecture, and this guideline will not try to enumerate them. Instead, it offers an outline and format that hopefully will encompass all architectural design research papers.

None of the following sections required this outline need to be extremely long. All should be clear and well thought out. None should be turgid and unreadable.

VALIDITY

Validity of AeroSpace Architecture papers is the over-arching concern. A paper must present a professional and responsible approach, that takes fully into account the conditions, assumptions, arrangements, and design requirements that affect the validity of the design research. In this sense, a “wild and crazy” design concept will rarely qualify as valid Space Architecture design research, because once the author

and designer works through all the constraints of the Space Environment, the he or she will find the "creative alternatives" severely restricted. Members of the Subcommittee have published a number of papers that address these environmental conditions, and they are available from the Subcommittee directly from the Chair or from our bibliographical website:
http://www.spacearchitect.org

For scientific papers, the statistical tests for validity take on special importance, but in Architectural Design Research papers, statistics rarely have a major role. However, many of the standard tests for validity apply, as best described in these two references:

Campbell, D. T., and Stanley, J. C., (1963). Experimental and Quasi-Experimental Designs for Research, Boston: Houghton Mifflin Company.

Cook, T. D. and Campbell, D. T., (1979). Quasi-Experimentation: Design and Analysis Issues for Field Settings, Chicago: Rand McNally College Publishing Company.

In AeroSpace Architecture, ***First Test for Validity*** is whether the proposed paper addresses realistically the actual conditions of the hostile space environment. These conditions include, in varying degrees: radiation, altered gravity regimes, vacuum and the artificial atmospheres necessary to overcome it, micrometeoroids, orbital space debris, dust impingement on planetary surfaces, among the most common. The proposed design of habitable space environments must afford appropriate and effective means to deal with these life-threatening conditions, as the health and safety of the human crew must always be the Space Architects highest priority. The use of structures and materials must be realistic, and if not within the technology readiness levels of existing materials and methods, the author must provide a well-supported technical explanation for why the proposed approach can succeed safely and reliably.

1. ABSTRACT:

The Abstract should summarize very briefly the essence of the paper. It should state the problem, the approach to the problem, whether an experiment or design exercise occurred, and the most significant result or finding.

2. INTRODUCTION

The Introduction consists of two essential parts: a) a statement of the purpose of the paper, such as the problem or research it addresses and b) a literature review. If the literature review must be very large or has some other special aspect or function, it may stand alone as its own section separate from the Introduction. The Introduction should also describe the context of the work what program or project it supports, and the larger goals and objectives of those efforts.

a. PROBLEM STATEMENT or RESEARCH STATEMENT:

The Problem Statement should explain clearly and concisely what the author is trying to accomplish and why. It should be careful to define the scope of a design problem, with an appraisal of how "well-structured" or "ill-structured" the current problem definition may be. It should state the importance of exploring or solving this problem. If the paper concerns a specific hypothesis, it should state the null hypothesis and the alternate hypothesis, and the results that would support or refute either one. However, in Design Research, it is rare to have a scientific hypothesis, and if your work does not fall legitimately within the scientific paradigm, it is essential to avoid giving a mistaken impression that it does. More often, Design Researchers deal with what one might call "Design Propositions," which are ideas that the researcher attempts to test through a design exercise. In this case, it is valuable and often essential to state the evaluation criteria for the design proposition(s) or for experimental measures.

b. LITERATURE REVIEW:

The Literature Review section is the part that perhaps more than any other sets Peer Review papers apart from others. The requirement is to show the reader where this concept, exercise, experiment, or analysis fits into the field or related projects. For example, any author writing about closed ecological systems should be able to explain what inheritance it receives from predecessor projects, and how it differs from it s predecessors and contemporaries or competitors. More specifically, a paper about a specific closed system should explain these similarities and differences with regard to the leading exemplars in the field, possibly including Bioplex at Johnson Space Center, the 90 Day Closed Life Support test for Skylab, Ioseph Gitlin's Russian closed chamber tests, Japanese closed botanical tests, Ames Research Center CELSS Chamber Tests, etc. Perhaps even more important than pointing out similarities is explaining differences and distinctions. For example, people

often ask if a closed system is like Biosphere 2 but of course, Biosphere 2 was anything but a closed system." The author should be able to make these differences clear if there is any possibility of confusion.

The underlying purpose of the Literature Review is to demonstrate that the author is fully up to speed on the current state of the art and that the paper does not simply "reinvent the wheel." If, in fact, a paper is about an effort to test or revalidate somebody else's experimental results, the paper should make that clear in both the Abstract and the Problem Statement. It is NOT the purpose of the Literature Review simply to add a fat section to the paper for padding. Some of the best Literature Reviews are quite slim, and may be only half a page to a page in length. Sometimes it works best to integrate the Literature Review with the Problem Statement or the Approach (see below). The key is to demonstrate expert knowledge of the literature and to place one's own work within it. In scientific disciplines, there are often major review articles to which the author can refer to cover a large part of the literature, but these review articles rarely exist in architecture. Therefore the burden upon the design research author may be somewhat greater than the science author to demonstrate knowledge of state of the art.

4. APPROACH:

A section on the Approach should lay out a simple and accessible explanation of what the author did to create the basis for the paper. This section is especially important for design research to provide a complete and accessible description of the design activity. If there is a set of detailed design requirements that lead to the design or otherwise support it, the Approach should summarize them. If there are internal or external constraints that limit the design, the Approach should state and explain them. If the paper addresses a set of design propositions too complex or elaborate for the Problem Statement, it may be more appropriate to state them as part of the Approach. If the design activity involves special design methods that have a bearing on the content of the paper (such as participatory design process, protocol analysis, virtual reality, perspective technique, etc.) the Approach section should explain it, and build upon coverage of it in the Literature Review.

5. NARRATIVE (optional):

The Narrative can provide a valuable and illuminating perspective for papers that

involve design process or the construction of a real-world environment or simulator. The Narrative should make the author's role clear as designer or researcher. It may be journalistic to the degree that it describes what happened, when it happened, where it happened, why it happened, and how it happened. Alternatively, it may be more effective to take a diary approach, describing the activity in chronological order. A narrative allows a wide range of latitude to the author.

6. OBSERVATIONS (optional):

If one is writing about a real-world construction, process or simulation, it is important to record one's observations and to present them, either verbally or graphically in the figures. In some cases, the observations may provide key empirical data, or lead to a serendipitous discovery, which the author should document. Observations are a good place to describe the unexpected. I tend to think of Observations as being somewhat akin to the American Institute of Architects approach to the Architects Field Report, on which the Architect observes (but does not inspect or supervise) the work in progress.

7. DATA (optional):

If the research involves experimental or empirical data, it demands a clear presentation and impartial analysis. This analysis should follow standard statistical research methods. If the paper makes an economic, mass, volume, power or other quantitative argument, the author may include the supporting figures under data, so long as it is clear what is "hard fact" and what is speculation.

8. EVALUATION:

Here the author should apply the evaluation criteria given in the Problem Statement (above) or elsewhere in the paper. The Evaluation should interpret the meaning of the observations and data. Did the research prove or disprove a hypothesis? Did it support or refute a theory? It is appropriate to evaluate what parts of a project succeed, and what fails; what went right and what went wrong.

If you are evaluating statistical data, please apply the relevant tests for validity. (Campbell & Stanley, 1963; Cook & Campbell, 1979). The experimental design

should anticipate evaluation for validity. In some cases of field or simulation research that is not primarily in the form of statistical data, applying tests of validity can strengthen or clarify the results.

Simulations pose a special case for evaluation because they can be so complex. It is essential to evaluate simulations for the degree of control versus realism, the degree to which it is experimental versus the degree to which it is production-oriented, as well as specific outcomes.

9. FINDINGS:

What did the research show? Did it create new knowledge? If so, what? Were the Observations, Data, and Evaluation results consistent with the Problem Statement? Does the research confirm or contradict the data points or precedents in the Literature Review? If the research involves a design project, did the project fulfill its program or succeed at its goals?

10. DISCUSSION:

Why did things go wrong or go right? What would you do differently? What happened that was unexpected? Why? What did you learn?

11. CONCLUSION:

Discuss the implications or consequences of the research. Does it prove or disprove something? What does it say about other projects or programs? Does it show that a particular approach is feasible or unfeasible?

Avoid predictions or suggestions for future research unless the paper identifies a specific experimental or empirical question that it leaves hanging, just waiting for an answer.

12. REFERENCES:

The AIAA AeroSpace Architecture Subcommittee has adopted the American

Psychological Associations Publications Handbook as its guideline for reference citations. http://www.apastyle.org/

The APA standard for electronic media and web pages is available on line at http://www.apastyle.org/elecref.html.

The Publication handbook is available only in hard copy, but there is a website at the University of Southern Missisippi that summarizes the key points of the reference citation standard:

http://www.lib.usm.edu/~instruct/guides/apa.html.

Provide the references in a bibliographical listing. List only those references that the author cites, discusses or refutes in the text. There are many standard formats for reference citations, by one recent count about 28 different formats that professional and technical societies promote. The Life Support and Biosphere Science Journal & conference have a format that they prefer. After trying many different formats, I found that the American Psychological Association's format is the most universal, easiest to follow and "cognitively correct." It is the format I use for the references in this guideline. If you cite a Web page, try to include the title, author, & hard copy publisher of the document -- not just the URL.

A standard reference source with which everyone writing about Life Support Systems should familiarize himself is the SAE Transactions that come out annually and are available in most major research university libraries.

13. FIGURES:

In keeping with the design disciplines, it may be appropriate to include drawings, photographs or other figures in any section of the paper. The paper should refer to the figure in the text, and discuss its significance, describing the salient aspects of what the figure shows. The figure should have a caption that identifies it and explains very briefly what it shows.

14. TABLES:

Tables are a common way of presenting data. They should be clear, consistent and

easy to read. The table should have a caption that identifies it and explains what the values are that it shows, and anything else that is not completely obvious.

15. LANGUAGE:

I am a strong believer that clarity of language is an excellent first order indicator of clarity of thought. The sentence structure and choice of words should be clear and precise. Strunk and White provide the best, shortest and most concise guide in The Elements of Style (sorry, I don't have the publisher). It is especially important to write sentences that have subjects and ACTIVE VERBS. For example:

GOOD: The designer made a mistake.

BAD: A mistake was made by the designer.

WORST: Mistakes were made. [but nobody made them]