How to Structure Reports on Experiments in Human-Computer Interaction

Saul Greenberg
Department of Computer Science
University of Calgary, Calgary, Canada T2N 1N4
e-mail: saul@cpsc.ucalgary.ca

Abstract

This document describes how a researcher should structure a report describing experiments in human computer interaction. The framework provided follows that of most scientific reports, where sections should: introduce the topic and problem; describe the experiment; note the key results obtained; discuss and interpret the results; and give concluding remarks. The document also indicates what archival records should be kept of the experiment.

Note: The title should be descriptive and enticing, and should be followed by the full names, contact addresses, and email address of the authors. Abstracts are typically a 100-150 word overview of experiment, results and discussion. Well-written abstracts summarize the key findings of the paper as well as introduce the problem, so the reader knows what to expect.

1. Introduction

This section should give an overview of the general problem area, and should then focus on the particular problem you are going to investigate. Some things typically included in an introduction are:

- general problem introduction and statement
- review of experimental and commercial systems
- discussion of the relevant literature (if any)
- personal encounters with the problem
- review of previous experiments
- relevant psychological or other theories

You should also introduce the structure of the rest of the paper.

Please note that the recommendations provided are meant to guide, not to restrict the writer; in themselves they are not a recipe for a good paper presentation (which often depends upon the kind of experiment done). However, this structure has been tried and tested over many decades in thousands of scientific research reports.

You should also know that typesetting requirements and paper length restrictions are often set by paper solicitors (especially for conferences). You will find that your biggest problem is fitting and pruning your write-up to the few pages allowed by the publishers!

1 Most of what is found in this document was authored by Saul Greenberg. Some modifications have been made by Joanna McGrenere to suit the HCI courses at UBC.
2. Description of the experiment

A critical aspect of scientific work is the ability for other researchers to replicate the experiment. This section should clearly define the problem, describe the subjects and the materials required, indicate the methodology, and list any problems encountered. Depending upon your particular experiment, the subsections below might be best presented in a different order and you may add further subsections as needed.

2.1 Introduction and goals
Introduce your experiment, and give the reader the specific goals you expect it to address. It is common at this stage to give the reader a hint of your hypotheses (if they are not already hinted at in the Introduction).

2.2 Methods
This is a detailed description of the experiment that should allow other researchers (familiar with HCI and experimental design in general, but not familiar with your experiment) to replicate your experiment.

2.2.1 Participants
Describe your participants (e.g., any relevant demographics, if/how they were divided into categories), including total number, and recruiting approach. Indicate if any incentives were used. Comment on the representativeness of your participants relative to the target population, if their representativeness isn’t immediately obvious.

2.2.2 Conditions
If your experiment is comparing multiple different interfaces or interactive systems or techniques, describe each of them. Screen snapshots of interfaces/systems are particularly useful.

2.2.3 Tasks
Briefly describe what participants were asked to do with the interactive system(s).

2.2.4 Design
Write the formal experimental design (e.g., a 2 x 3 mixed factorial design, more specifically a 2 levels of expertise (between subjects) x 3 interfaces (within subjects) design).

2.2.5 Procedure
Describe the sequence of activities each participant followed. This should document the experiment from a participant’s perspective, from the moment s/he arrives (e.g., a preliminary questionnaire to obtain X information, followed by five tasks with system A, then a 10 min break, followed by the same five tasks with system B, and finally a semi-structured interview to solicit opinion on Y).

2.2.6 Apparatus
Describe the physical setup of the experiment (e.g., where was it conducted, on what kind of equipment, etc.)

2.2.7 Independent and dependent variables
Include exactly how you intend to measure each dependent variable.
2.2.8 Hypotheses

Remember to state these in terms of the independent and dependent variables. If it is not immediately clear why you would have a certain hypothesis (it often follows logically from the introduction of the experiment), then include a brief explanation separate from but following the hypothesis. You do not need to state the null hypothesis.

2.3 Problems/Limitations

Describe any problems/limitations encountered that will help other researchers avoid or account for them if they decide to replicate your experiment.

3. Results

3.1 Quantitative Results

This section is an objective report on what the numbers show. You should not try to interpret the meaning of the numbers in this section. Some of the things you may do here are:

- report means and standard deviations in neat tables
- indicate the statistics used and levels of significance
- include graphs, plots, histograms, etc that tell a story about the actual figures obtained

Only critical raw data and summary statistics should be included in the actual report. However, you must keep all your raw data in a separate archival report, should anyone (a reviewer in the case of real scientific reporting) need more detail than is provided in the paper.

3.2 Qualitative Results

This section reports the analysis of the qualitative data, usually from interviews and free-form questions on questionnaires.

Remember that the division between quantitative and qualitative results is generally not clean cut. For example, a questionnaire may have closed questions that can be analyzed quantitatively.

4. Discussion

Interpret the results. Although you should still try to be as objective as possible, the discussion section should illuminate your critical thinking about the results. Explain what the statistics mean, account for anomalies, and so on.

4.1 Interpretation of results

Discuss what you believe the results really mean. For example, if you find a significant difference for some effect, what does that mean to the hypothesis? Is the different seen an important one?

4.2 Relation to other works

How do the results you’ve obtained relate to other research findings?

4.3 Impact for practitioners

As computer scientists, we are particularly concerned with the implications of our findings on practitioners. Should existing interface constructs be designed differently or used in a new context? Do you have suggestions for new designs? How can the findings be generalized?
4.4 Limitations
Critical reflection is one of the key foundations of science. You should criticize your work (constructively, if possible), indicate possible flaws, threats to validity, mitigating circumstances, the limits to generalization, conditions under which you would expect your findings to be reversed, and so on.

4.5 Future Work
The best experiments suggest new avenues of exploration. In this section, you should reflect and refine, perhaps your hypotheses and your motivation. Suggest future research, i.e., research that you would do if you continued along this path.

5. Conclusions
Summarize the report, and speculate on what is to come.

Acknowledgements
This section should give thanks to the major people (supervisors, associates) and organizations (sponsoring agencies, funders) that helped you. For example, I would like to thank Ben Shneiderman, whose report framework was used to build this one.

References
This list should contain only papers that have been cited in text. Citations should be in a standard form, and should include all citation information. An example citation is given below (Greenberg 1991).


Additional Resources (not a section to be included in the report)
It can be helpful to see sample experiment write-ups found in the literature. Here are some which you may find useful.
