

Principles for Tools Supporting Engineering Design Challenges at Scale

Elena L. Glassman
MIT CSAIL
elg@mit.edu

Chris Terman
MIT CSAIL
cjt@mit.edu

Robert C. Miller
MIT CSAIL
rcm@mit.edu

ABSTRACT

Peer-instruction, peer-reviewing, and more recently learner-sourcing can help students learn, especially when the student-to-staff ratio is high. We describe three deployed learner-sourcing scenarios within the context of an undergraduate digital design class. The key design principle is students should be directed to hints written by other students who have just completed the task themselves. Initial results are promising, and warrant follow-up work.

Author Keywords

engineering education; crowd-sourcing

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

INTRODUCTION

A TA will never had done it the length of time as the lecturer whose taught the course, who understands the relative frequencies and value of design decisions that students make while working on engineering challenges. Furthermore, while the TA is expected to solve the lab before coming in to help the students, they can only be expected to solve it one way, of all the potential ways students choose.

jsolution: crowd-sourcing with incentives and guiding constraints; The collective activity of large classes can map out Students can become the local experts on what they implemented, which is both valuable pedagogically and from the perspective of scaling classes up without always having the staff to support them.

PAGE SIZE AND COLUMNS

On each page your material (not including the page number) should fit within a rectangle of 18 x 23.5 cm (7 x 9.25 in.), centered on a US letter page, beginning 1.9 cm (.75 in.) from the top of the page, with a .85 cm (.33 in.) space between two 8.4 cm (3.3 in.) columns. Right margins should be justified, not ragged. Beware, especially when using this template on a Macintosh, Word can change these dimensions in unexpected ways. Please be sure that your PDF is US letter and not A4. If

your PDF or paper are formatted for A4, the submission will be returned to you to fix.

TYPESET TEXT

Prepare your submissions on a word processor or typesetter. Please note that page layout may change slightly depending upon the printer you have specified. \LaTeX sometimes will create overfull lines that extend into columns. To attempt to combat this, the .cls file has a command, `\sloppy`, that essentially asks \LaTeX to prefer underfull lines with extra white-space. For more details on this, and info on how to control it more finely, check out <http://www.economics.utoronto.ca/osborne/latex/PMAKEUP.HTM>.

Title and Authors

Your paper's title, authors and affiliations should run across the full width of the page in a single column 17.8 cm (7 in.) wide. The title should be in Helvetica 18-point bold; use Arial if Helvetica is not available. Authors' names should be in Times Roman 12-point bold, and affiliations in Times Roman 12-point. For more than three authors, you may have to place some address information in a footnote, or in a named section at the end of your paper. Please use full international addresses and telephone dialing prefixes. Leave one 10-pt line of white space below the last line of affiliations.

Abstract and Keywords

Every submission should begin with an abstract of about 150 words, followed by a set of keywords. The abstract and keywords should be placed in the left column of the first page under the left half of the title. The abstract should be a concise statement of the problem, approach and conclusions of the work described. It should clearly state the paper's contribution to the field of HCI.

The first set of keywords will be used to index the paper in the proceedings. The second set are used to catalogue the paper in the ACM Digital Library. The latter are entries from the ACM Classification System [3]. In general, it should only be necessary to pick one or more of the H5 subcategories, see <http://www.acm.org/class/1998/ccs98.html>

Normal or Body Text

Please use a 10-point Times Roman font or, if this is unavailable, another proportional font with serifs, as close as possible in appearance to Times Roman 10-point. The Press 10-point font available to users of Script is a good substitute for Times Roman. If Times Roman is not available, try the font named Computer Modern Roman. On a Macintosh, use the font named Times and not Times New Roman. Please use

sans-serif or non-proportional fonts only for special purposes, such as headings or source code text.

First Page Copyright Notice

Leave 3 cm (1.25 in.) of blank space for the copyright notice at the bottom of the left column of the first page. In this template a floating text box will automatically generate the required space. Note however that the text box is anchored to the **ABSTRACT** heading, so if that heading is deleted the text box will disappear as well. You can replace the default copyright notice by uncommenting the `\toappear` block at the beginning of the document and inserting your own text, for example, for versions under review.

Subsequent Pages

On pages beyond the first, start at the top of the page and continue in double-column format. The two columns on the last page should be of equal length.



Figure 1. With Caption Below, be sure to have a good resolution image (see item D within the preparation instructions).

References and Citations

Use a numbered list of references at the end of the article, ordered alphabetically by first author, and referenced by numbers in brackets [2, 4, 5, 7]. For papers from conference proceedings, include the title of the paper and an abbreviated name of the conference (e.g., for Interact 2003 proceedings, use *Proc. Interact 2003*). Do not include the location of the conference or the exact date; do include the page numbers if available. See the examples of citations at the end of this document. Within this template file, use the `References` style for the text of your citation.

Your references should be published materials accessible to the public. Internal technical reports may be cited only if they are easily accessible (i.e., you provide the address for obtaining the report within your citation) and may be obtained by any reader for a nominal fee. Proprietary information may not be cited. Private communications should be acknowledged in the main text, not referenced (e.g., “[Robertson, personal communication]”).

SECTIONS

Objects	Caption — pre-2002	Caption — 2003 and afterwards
Tables	Above	Below
Figures	Below	Below

Table 1. Table captions should be placed below the table.

The heading of a section should be in Helvetica 9-point bold, all in capitals. Use Arial if Helvetica is not available. Sections should not be numbered.

Subsections

Headings of subsections should be in Helvetica 9-point bold with initial letters capitalized. For sub-sections and sub-subsections, a word like *the* or *of* is not capitalized unless it is the first word of the heading.)

Sub-subsections

Headings for sub-subsections should be in Helvetica 9-point italic with initial letters capitalized. Standard `\section`, `\subsection`, and `\subsubsection` commands will work fine.

FIGURES/CAPTIONS

Place figures and tables at the top or bottom of the appropriate column or columns, on the same page as the relevant text (see Figure 1). A figure or table may extend across both columns to a maximum width of 17.78 cm (7 in.).

Captions should be Times New Roman 9-point bold. They should be numbered (e.g., “Table 1” or “Figure 1”), centered and placed beneath the figure or table. Please note that the words “Figure” and “Table” should be spelled out (e.g., “Figure” rather than “Fig.”) wherever they occur.

Papers and notes may use color figures, which are included in the page limit; the figures must be usable when printed in black and white in the proceedings. The paper may be accompanied by a short video figure up to five minutes in length. However, the paper should stand on its own without the video figure, as the video may not be available to everyone who reads the paper.

LANGUAGE, STYLE AND CONTENT

The written and spoken language of SIGCHI is English. Spelling and punctuation may use any dialect of English (e.g., British, Canadian, US, etc.) provided this is done consistently. Hyphenation is optional. To ensure suitability for an international audience, please pay attention to the following:

- Write in a straightforward style.
- Try to avoid long or complex sentence structures.
- Briefly define or explain all technical terms that may be unfamiliar to readers.
- Explain all acronyms the first time they are used in your text—e.g., “Digital Signal Processing (DSP)”.
- Explain local references (e.g., not everyone knows all city names in a particular country).

- Explain “insider” comments. Ensure that your whole audience understands any reference whose meaning you do not describe (e.g., do not assume that everyone has used a Macintosh or a particular application).
- Explain colloquial language and puns. Understanding phrases like “red herring” may require a local knowledge of English. Humor and irony are difficult to translate.
- Use unambiguous forms for culturally localized concepts, such as times, dates, currencies and numbers (e.g., “1-5-97” or “5/1/97” may mean 5 January or 1 May, and “seven o’clock” may mean 7:00 am or 19:00). For currencies, indicate equivalences—e.g., “Participants were paid 10,000 lire, or roughly \$5.”
- Be careful with the use of gender-specific pronouns (he, she) and other gendered words (chairman, manpower, man-months). Use inclusive language that is gender-neutral (e.g., she or he, they, s/he, chair, staff, staff-hours, person-years). See [6] for further advice and examples regarding gender and other personal attributes.
- If possible, use the full (extended) alphabetic character set for names of persons, institutions, and places (e.g., Grønbaek, Lafrenière, Sánchez, Universität, Weißenbach, Züllighoven, Århus, etc.). These characters are already included in most versions of Times, Helvetica, and Arial fonts.

ACCESSIBILITY

The Executive Council of SIGCHI has committed to making SIGCHI conferences more inclusive for researchers, practitioners, and educators with disabilities. As a part of this goal, the all authors are asked to work on improving the accessibility of their submissions. Specifically, we encourage authors to carry out the following five steps:

1. Add alternative text to all figures
2. Mark table headings
3. Add tags to the PDF
4. Verify the default language
5. Set the tab order to “Use Document Structure”

Unfortunately good tools do not yet exist to create tagged PDF files from LaTeX. LaTeX users will need to carry out all of the above steps in the PDF directly using Adobe Acrobat, after the PDF has been generated.

For more information and links to instructions and resources, please see: <http://chi2014.acm.org/authors/guide-to-an-accessible-submission>.

PAGE NUMBERING, HEADERS AND FOOTERS

Please submit your anonymous version for reviewing with page numbers centered in the footer. These must be removed in the final version of accepted papers, as page numbers, headers, and footers will be added by the conference printers. Comment out the `\pagenumbering` command at the top of the document to remove page numbers.

DEAR BETA: OPTIMIZATION EDITION

Description

Design Challenges

- shorter spaces between check-ins with sheet
- automated population of fields/calculation of change in benchmark (less lowfi)
- no enough incentive to participate
- lacks debugging tips as well (perhaps just as plentiful)

FUTURE WORK

- deploy ‘real’ version of Dear Beta system for 6.004x, which does double-duty for optimization as well, since that involves bugs too
- do git diffs on optimization of betas this term to see what folks actually did this term?
- create separate interface in which students can see their own place in space and time, along with diffs, and the ability to comment what they did (via API), with pull-down suggestions from other folks ;– more of a personal help system that motivates them to annotate.

ACKNOWLEDGMENTS

We thank CHI, PDC and CSCW volunteers, and all publications support and staff, who wrote and provided helpful comments on previous versions of this document. Some of the references cited in this paper are included for illustrative purposes only. **Don’t forget to acknowledge funding sources as well**, so you don’t wind up having to correct it later.

REFERENCES FORMAT

References must be the same font size as other body text.

REFERENCES

1. Adobe Acrobat Reader 7.
<http://www.adobe.com/products/acrobat/>.
2. Anderson, R. E. Social Impacts of Computing: Codes of Professional Ethics. *Social Science Computer Review* December 10, 4 (1992), 453–469.
3. How to Classify Works Using ACM’s Computing Classification System.
http://www.acm.org/class/how_to_use.html.
4. Klemmer, S. R., Thomsen, M., Phelps-Goodman, E., Lee, R., and Landay, J. A. Where do web sites come from?: capturing and interacting with design history. In *Proc. CHI 2002*, ACM Press (2002), 1–8.
5. Mather, B. D. Making up titles for conference papers. In *Ext. Abstracts CHI 2000*, ACM Press (2000), 1–2.
6. Schwartz, M. *Guidelines for Bias-Free Writing*. Indiana University Press, 1995.
7. Zellweger, P. T., Bouvin, N. O., Jehøj, H., and Mackinlay, J. D. Fluid annotations in an open world. In *Proc. Hypertext 2001*, ACM Press (2001), 9–18.