Pale and Male: 19th Century Design in a 21st Century World

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I had a clear line of argument in mind when I agreed to contribute this editorial: that while there are many reasons for striving to increase the representation of women in our field, the *selfish* reason is the most compelling one: the quality of the solutions we achieve is enhanced by the diversity of the individuals contributing to these solutions.

I quickly discovered that a colleague had already made this point far better than I could ever hope to. In the Winter 1998 issue of *The Bridge* (the quarterly journal of the National Academy of Engineering), NAE President and eminent computer scientist Bill Wulf wrote [1]:

> "A lot of people argue for diversity in terms of fairness. We Americans are very sensitive to issues of fairness, but that's not my argument. Others argue in terms of simple numerics: Male Caucasians will be the minority in the 21st century, and so to meet the need for engineers we will have to attract women and underrepresented minorities. That's true too, but that's not my argument, either.
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> "I believe there is a far deeper reason why we require a diverse work force. Let me give you the argument in a nutshell, and then I'll try to draw it out more carefully.
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> "First, engineering is a very *creative* profession. That is not the way it is usually described, but down to my toes I believe that engineering is *profoundly* creative. Second, as in any creative profession, what comes out is a function of the life experiences of the people who do it. Finally, sans diversity, we limit the set of life experiences that are applied, and as a result, we pay an opportunity cost - a cost in products not built, in designs not considered, in constraints not understood, in processes not invented …
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> "There is a real economic cost to that. Unfortunately, it is an opportunity cost. It is measured in design options not considered, in needs unsatisfied and hence unfulfilled. It is measured in "might have beens," and those kinds of costs are very hard to measure. That doesn't change the fact that they are very real and very important.
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> "Every time we approach an engineering problem with a pale, male design team, we may not find the best solution. We may not understand the design options or know how to evaluate the constraints. We may not even understand the full dimension of the problem."
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> Excerpted from Wm. A. Wulf, "Diversity in Engineering," *The Bridge*, Vol. 28, No. 4, Winter 1998,
> http://www.nae.edu/Publications/Bridge/CompetitiveMaterialsandSolutions/DiversityinEngineering.aspx

Bill has hit the nail on the head – as he inevitably does. I urge you to follow the web link and read the full text of his remarks, which were originally presented at the 1998 National Academy of Engineering Annual Meeting. Engineering solutions are enriched and enhanced by the

diversity of the engineering teams that create these solutions. A non-diverse engineering workforce inevitably leads to diminished – indeed, impoverished – engineering solutions.

What's to be done? Professor Leah Jamieson of Purdue University, in her July 1999 President's Message in *IEEE Signal Processing Magazine* [2], cites a UC Davis study published in the *Journal of Engineering Education* [3] which found five principal factors that cause women to leave, or to become discouraged with, engineering. (I encourage you to read Leah's editorial, http://cobweb.ecn.purdue.edu/~lhj/SPS/WomenInEng.html, and a companion piece that appeared in the next issue of the same magazine, http://cobweb.ecn.purdue.edu/~lhj/SPS/Women_part2.html [4].) The five factors are:

- *Isolation* – a sense of distance from one's peers, due to factors that include the intensive workload of majors in technical fields, as well as under-representation
- *Inability to see the relevance of highly theoretical basic courses* – these courses often seem like hurdles that must be surmounted, with little "real world" relevance
- *Negative experiences in laboratory courses* – due to factors such as a lack of prior experience with "how things work," and stereotyping by lab instructors and/or lab partners
- *Classroom climate* – for example, the interaction style of the professor or of fellow students
- *Lack of role models*

Think about these five factors for a minute. They affect women (and other under-represented groups) disproportionately, but each of them constitutes a substantial negative for *all* prospective computer scientists and engineers. Do many of your freshmen feel isolated from other students, or is it just the women? Do the majority of the pale males find your introductory courses relevant? Is it only women who come to college lacking hands-on real-world experience, or does this affliction increasingly characterize your student body at large? Are enough of your students – regardless of gender – active classroom participants? Is the image of our field what you'd like it to be, or is it, in all honesty, pretty lousy?

We need to get off our butts and *fix these things!* The future of our field – the quality of the solutions that we achieve – depends upon it. It is perhaps the most important thing that we can do.

And we *can* do it. For some excellent ideas on how to get started, see two articles in this Special Issue: those by Margolis and Fisher [5] (especially the conclusions) and by Cuny and Aspray [6].

References

[1] Wm. A. Wulf, "Diversity in Engineering," *The Bridge*, Vol. 28, No. 4, Winter 1998, http://www.nae.edu/Publications/Bridge/CompetitiveMaterialsandSolutions/DiversityinEngineering.aspx

[2] L.H. Jamieson, "President's Message: Cherchez la Femme," *IEEE Signal Processing Magazine*, Vol. 16, No. 4, July 1999, http://cobweb.ecn.purdue.edu/~lhj/SPS/WomenInEng.html

[3] R. Henes, M. Bland, J. Darby, and K. McDonald, "Improving the Academic Environment for Women Engineering Students through Faculty Workshops," *J. of Engineering Education*, January 1995, summary at http://www.onlineethics.org/cms/8629.aspx

[4] L.H. Jamieson, "President's Message: Do it for Your Daughters," *IEEE Signal Processing Magazine*, Vol. 16, No. 5, September 1999, http://cobweb.ecn.purdue.edu/~lhj/SPS/Women_part2.html

[5] J. Margolis and A. Fisher, "Unlocking the Clubhouse: The Carnegie Mellon Experience," *Inroads (The SIGCSE Bulletin)*, Vol. 34, No. 2, 2002 (this issue), http://lazowska.cs.washington.edu/fisher.inroads.pdf

[6] J. Cuny and W. Aspray, "Recruitment and Retention of Women Graduates in Computer Science and Engineering," report of a workshop organized by the Computing Research Association, San Francisco CA, June 21-22 2000, reprinted in *Inroads (The SIGCSE Bulletin)*, Vol. 34, No. 2, 2002 (this issue), http://lazowska.cs.washington.edu/cuny.inroads.pdf

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