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Review of 'Girls coming to Tech! A History of American Engineering Education for Women' by Amy Sue Bix

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REVIEW

The book under review, *Girls Coming to Tech!*, is a well-researched, systematically drafted work of great importance. It concerns the history of women in engineering, which remains neglected and sparsely studied, not only in America but also everywhere else, in comparison to women in science. The book deals with the intellectual, institutional, and social revolution in gender dimensions of engineering education from the late 1800s through to most of the 20th century in America. It gives a vivid description of how women entered the field of engineering in America during the late 19th and early 20th centuries. Bix describes the oddities, the outcasts, the ridicule and the criticism so well that the reader is practically transported to the period! For decades, women who studied or worked in engineering were popularly perceived as unfeminine (or inappropriately feminine in a male world). Her writing describes how the focus used to be on the women's bodies rather than their brains, and how women were reduced to sex objects, which resulted in making both social and emotional life harsher for them. This had several serious implications. For example, women were not only discouraged; women remained extremely low in number in the profession.

In *Girls Coming to Tech!* Amy Bix tells the story of how women gained entrance and fought. She captures very well the voices of numerous female students who could enter engineering education on the one hand and those who interacted with them within the prevailing historical contexts on the other.

The beauty of the book lies in revealing the unique psychological and personal experiences of women entering engineering studies. It begins with an introduction that sets the background. The chapter titles are apt and the divisions are well thought through. Bix offers three detailed case studies of post-war engineering coeducation. After a crisp introduction, the first chapter describes how a handful of women were able to breach the gender-reinforced boundaries of engineering education and in a way "invade" the fields of engineering education and work. It details individually those few women who crossed the boundaries of masculine engineering education. The second and third chapters deal with wartime and its consequences. During World War II, government, employers, and colleges actively recruited women to train as engineering aides, channeling them directly into defense work. These wartime training programs set the scene for more engineering schools to open their doors to women. World War II was a crucial transition – it brought a number of "firsts" for women in engineering. The Curtiss-Wright Cadettes of World War II played a significant role in this.

The next three chapters take up the post World War debates using case studies from three high profile universities to illustrate the story: these are MIT, Georgia Tech, and Caltech into which a few women were grudgingly admitted. The book highlights the harsh initial resistances they encountered, as well as the lack of willingness and the indifference to coeducation. Georgia Tech admitted women in 1952 to avoid a court case, overriding objections from traditionalists. In 1968, Caltech's male students argued that nerds needed a civilizing female presence. Caltech defined women as "foreign creatures" who were strangers to the technical world. The masculine academic culture of the institute encouraged male students to assess female classmates as potential girlfriends, amusements or sex objects rather than as intellectual equals and future professional colleagues. At MIT, which had admitted women since the 1870s but treated them as a minor afterthought, feminist-era activists pushed the school to welcome more women and take their talent seriously. Elsewhwere too such attitudes prevailed. In 1955, Penn State's Dean of Engineering, for example, declared, "Women are NOT for engineering," asserting that all but a few "unusual women" such as Lillian Gilbreth lacked the "basic capabilities" necessary. However, the changes at institutions, such as Georgia Tech and in the broader educational and social context of United States continued to result in an increase of women's presence. Bix provides detailed descriptions of how each of the three institutions gradually realized that admitting a small number of female students was not enough to ensure that they thrived academically and socially.

Finally, the book describes how the gradual changes led to recent developments. The final chapter offers an account of how women's enrollment in American undergraduate engineering programs gradually rose and reveals the many challenges women encountered as students. Bix goes beyond education and also deals with the women's entry as professionals into the unwelcoming route to industry, despite a Westinghouse policy to "hire no women". The book ends with an analysis of the situation in the 21st century and highlights the changes in the educational pattern and professional climate. Across all the disciplines, engineering graduates have the lowest number of women; the ratio has improved but is uneven even in the 21st century. In the 1950s, women made up less than 1% of students in American engineering programs; in 2010 and 2011, women earned 18.4% of bachelor's degrees, 22.6% of master's degrees, and 21.8% of doctorates in engineering. Bix recounts these hard-won gains beautifully.

The book provides a good analysis of the historical background that set the scene for the ongoing tension that faces women in engineering, but does not include much discussion of the gender–technology associations per se. Could the extant theoretical perspectives be relevant or explain the American situation? Does the "invasion" story have anything to do with the place of women in wider society – apart from the stereotype that engineering belonged to men? The strength of the book, however, lies in bringing into focus, through the lens of the history of women in engineering, the dramatic revolution that has occurred in American institutions, social assumptions, and individual lives. The book also offers relevant and eye-catching photos, illustrations, and cartoons. The only thing that might have benefitted from more explicit discussion by the author is the gender–technology association and the various perspectives and theories that explain the link.

Amy Sue Bix deals with historical data in a comprehensive way and makes it accessible to all sorts of readers – historians or non-historians! Her book will introduce gender concerns even to those who are not currently sensitive to them. Reading this book is a very enlightening and absorbing experience, and it makes an invaluable contribution to Science and Technology Studies.