She's an Engineer? Princeton Alumnae Reflect

Yvonne Ng '91 and

Jennifer Rexford '91

EDITORS

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PRINCETON, NEW JERSEY

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Published at Princeton University, Princeton, New Jersey

To our first teachers — our parents

Contents

Prologue: Women and the Princeton Engineering Experience ix

Introduction 1

An Engineering Grab Bag: Perceptions and Self-perceptions 9

Choosing Engineering and Staying In 23

The Princeton Experience: Engineering and More 53

Women and Engineering 97

Critiquing Princeton: The Good, the Bad, and the Unresolved 117

Graduate Students: A Small Sampling 135

After Princeton: Life Outside the Bubble 149

Graphs 165

Related Reading 169

Prologue: Women and the Princeton Engineering Experience

During the past year [1989], Princeton University has witnessed many "celebrations" for the 20th anniversary of the University's coeducation. We as engineers, however, believe that the engineering experience has not been adequately explored: Have B.S.E. students had a different coeducation experience than their A.B. counterparts? This project is an attempt to fill this gap. We are interested in compiling a book of anecdotes and reflections as well as statistics to flesh out the different aspects of the engineering coeducation experience.

—From the letter sent by the editors soliciting submissions for this book

In 1989 a group of Princeton undergraduates published *Women Reflect About Princeton* (WRAP). This book documented the experiences of undergraduate and graduate women who studied at Princeton since coeducation was established in 1969. As female students at Princeton, we read the book with great interest but found that, except for one lone voice, we had no idea what women engineers had experienced in Princeton's past—what their thoughts were, how Princeton prepared them technically and socially for the "real world."

Two years went by and we continued our lives as Princeton engineers, taking technical courses interspersed with liberal arts ones, and women's studies was one of our many interests. In these lectures, we found that when engineering was discussed, little information was available and little understanding of the engineering world was used in its analysis. This project is an attempt to fill that void by soliciting the experiences of former and current women engineering students.

This book is not meant to be a scholarly analysis of women, engineering, or women engineers. Instead, it intends to pull the reader into the world of engineering in an attempt to know it as more than just measured data, instruments, and math.

Not every engineer relates to the field in the same way. Some choose engineering because they are interested in the details of the technical world or like the rigorous method of problem-solving; some because it is "a sensible career choice"; still others because they want "to make a difference—to improve the world and make it a better place." Understanding the world of engineering bridges

the gap between engineers and those who are affected by their work.

Women as engineers have taken the road less traveled, whether or not they see it that way. As a result, they have had to constantly reflect on their motivation. Many of them are very self-probing, taking (as good engineers do) their goals and ideals in one hand and weighing them with the realities of the world in the other. The engineering philosophy is well suited for the sociological situation of women engineers—"the challenge is doing the best job in the real (though imperfect) world."

For those readers who are engineers, this journey will be largely familiar; however, we hope that all our readers approach the unfamiliar with an open mind and compassion.

For those who are not engineers, we hope that this presents a picture of not only the world of engineers, but also the depths of their character. Trite as it may sound, engineers do not fall into stereotypes easily: We may seem to be jocks, musicians, entrepreneurs, researchers, women, or men—no matter our looks, talents, or goals, we are all engineers.

When this project first started, we weren't sure what kind of response we'd receive. The project name, "Women in Engineering," smacked of "feminism," and we knew that many of our colleagues did not see themselves as feminists; quite often, feminism was the "F-word" at the E-Quad. Our experience showed us that although they did not mind being "women" or "engineers," being a "woman engineer" was not something that they wished to emphasize or vocalize beyond private conversations.

The first few submissions we solicited were from our friends and classmates, people who knew us well enough to expect fair treatment of their comments. One person kindly remarked, "I know that you'll print something you don't agree with in order to be accurate." We greatly appreciate their trust.

Aware that the engineering alumnae might have reservations about a "women in engineering" project, we speculated about their response: What could we expect from these people to whom we were complete strangers? The participants would have to trust us to represent them as they intended; they risked our quoting them out of context or biasing their words with commentary. As the submissions flowed in, we were greatly impressed with each. The contributors obviously took a good deal of time out of their busy schedules to write thoughtful and unabashedly honest reflections about themselves, Princeton, and their careers. We think their efforts reflect a shared love of both engineering and Princeton; we believe their cooperation has made this project a success.

This book was created by and is dedicated to these student and alumnae contributors; we hope we have honored their trust.

It's too bad that society isn't to the point yet where the country could just send up a woman astronaut and nobody would think twice about it.

— Sally Ride

Introduction

Some Background

In 1970 women earned less than 1 percent of engineering bachelor's degrees awarded in the United States. This number has increased to just over 15 percent, with the most dramatic increases occurring in the '70s.[9] The past decade has seen an explosion in the number of private and government programs designed to encourage women to enter technical fields, and now nearly all schools offering engineering degrees are coeducational. The representation of women in the various engineering disciplines, however, has not changed significantly in the past ten years.

The effort to increase the number of women in technical majors is part of an overall attempt to stimulate national interest and involvement in science and engineering. As the century draws near its close, the United States struggles to stay competitive in the high-tech world market. The National Science Foundation (NSF) has a national goal: "By the year 2000, U.S. students will be first in the world in mathematics and science achievement."[8] Minorities and women are seen as a huge, untapped resource that are a crucial part of reaching this goal.

Increasing national interest in science and engineering will prove difficult to accomplish. An NSF study of the four million high school sophomores in 1977 found that only 18 percent of the students were considering work in a technical field; by the time they were seniors, just 15 percent had an interest in science or engineering. Only 5 percent of the students went on to pursue an undergraduate degree in a technical discipline; less than one-quarter of 1 percent of the four million students received a doctoral degree in science or engineering.[10]

A variety of factors are responsible for this general lack of interest in technical fields. Many explanations relate to problems in American education; others deal specifically with science and engineering. In particular, most youngsters have a poor image of science and scientists. Math and science classes are often considered dry and boring, difficult and taxing. In movies and television, the scientist is often a bespectacled, socially inept geek who works alone; a clumsy, absent-minded researcher; or a mad demon plotting the destruction of the world. Moreover, the scientist does work that nobody else can understand. Engineers and scientists generally do not receive the public glamour of the doctors, businessmen, and lawyers; it is truly uncommon for a major television character to work as an engineer or scientist. Although engineering and science are a ubiquitous part of modern life, engineers and scientists are seldom seen.

Most high school graduates are academically unprepared for college study of science and engineering. Only 18 percent of high school seniors have ever taken a physics course; interestingly, two-thirds of this group are males.[11] In fact, some high schools do not offer physics classes. In addition, most students do not have a sufficient mathematics background. "Without adequate proficiency in mathematics, entrance into engineering careers is restricted. Mathematics may be the single most important factor in determining admission and success in engineering programs."[9] Having calculus or at least pre-calculus exposure in high school is not only crucial for engineering study, it is also important for most other technical bachelor's degrees. Mathematics also plays an important role in other fields, such as economics, business, and psychology. Some studies estimate that by not taking elective math classes in high school, students disqualify themselves from more than half of available college majors. Girls are less likely than boys to take elective math and science classes in high school and thus are more likely to eliminate many choices of potential college majors.

Many popular stereotypes about men and women are based on supposed differences in cognitive style; on the assumption that men are analytical and logical, whereas women are emotional and personal. This suggests that science and mathematics are somehow discordant with femininity. Studies do show the existence of a verbal/mathematical or verbal/spatial performance gap between females and males. Men, as a group, outperform women in mathematical and spatial tasks; likewise, women generally score higher than men on tests of verbal ability. These traits are difficult to measure, since few tasks require the use of a single, elemental skill, but most psychologists agree that differences exist.

The exact causes of the gap are difficult to uncover. Neither socialization nor biology may give a complete picture. The key, though, is that the detected differences, whether biologically or culturally induced, are not large and are statistical in nature. Many men excel over the "average" woman in verbal tasks; many women outperform the "typical" man in mathematical and spatial tests. Research suggests that the gap first appears during adolescence,[4] where it is difficult to isolate biological factors from the cultural environment. Until junior high school or early high school, girls and boys perform at the same level. Studies also show that, for both sexes, "independence (autonomy) is positively associated with good intellectual performance, particularly on tests on spatial ability. Girls' poorer performance on these tests may stem from greater dependency."[4]

The stereotype that men are mathematical and logical, whereas women are verbal and emotional, can perpetuate itself in various ways. In their book on sex differences, Maccoby and Jacklin identify three psychological theories for sex differentiation: imitation, praise and discouragement, and self-socialization.[9] The imitation theory suggests that children model much of their behavior after other members of their sex, particularly a parent. The praise/discouragement theory asserts that parents and society reward boys for "masculinity" and discourage them from "female" behavior; likewise, girls are praised for their "femininity"

and punished for participation in "male" activities. In the self-socialization theory, children strive to fit into their conception of gender identity; a young male wants to feel like a "normal" boy, whereas the young female wants to be a "normal" girl. Children can develop their notions of gender from virtually everything—family, friends, teachers, music, magazines, television, and so forth.

During elementary school, "girls perform better than boys on mathematics achievement tests. As they get older, girls' and boys' scores even out, and by high school the scores for boys are higher than for girls."[2] Performance in the sciences follows a similar path. This decline in achievement is accompanied by a decrease in self-esteem in science and math; "girls' self-confidence declines upon entering adolescence and is impacted by the view that mathematics and science are male activities."[11] Girls, as a group, also are less likely to have math and science experiences outside of the classroom. By seventh grade, "most boys and girls had a chance to use a microscope (probably in their science class). However, girls, far less than boys, had opportunities to play with a telescope, barometer, or electricity meter."[5] This pattern continues throughout high school.

Another reason some women may not pursue technical degrees relates to teachers and guidance counselors. Certainly, good and enthusiastic teachers can be important mentors to students interested in technical fields. Although many students, both male and female, have had significant positive experiences with their counselors and teachers, one study found that "42 percent of girls who were interested in careers in mathematics or science said that they had been discouraged by their counselors rather than encouraged to take advanced courses."[11] Other research has found that, as a group, "women who reported having been influenced by their high school teachers and counselors in making college plans were *less* likely to major in science."[2]

Although many studies and programs link engineering with science and mathematics when addressing the low number of women in technical fields, women's representation in engineering is significantly lower than in most other technical disciplines. In 1960 women accounted for 4 percent of physicists, 7 percent of physicians and surgeons, 9 percent of natural scientists, 26 percent of mathematicians, 27 percent of biological scientists, and less than 1 percent of all engineers.[6] Currently, women constitute one of every three scientists, but only one of every twenty-five engineers.[12] These low figures for engineering may be due in part to the lack of formal exposure to engineering before college. High schools offer courses in mathematics and science, but rarely in engineering. As a result, few high school students know much about the various engineering disciplines.

Additionally, popular books, TV shows, and movies have even fewer images of engineers than they do of scientists. Youngsters have the opportunity to prepare for engineering careers by taking math and science classes in high school, but secondary school offers little academic opportunity for engineering practice—using scientific and mathematical principles to design, build, and create. Students get some informal exposure to engineering by tinkering—"hands-on"

experience with cars, erector sets, trains, electronics, model planes, and so forth. A lack of engineering experiences in the classroom makes students more dependent on extracurricular activities for exposure to the field. In many cases, relatives, teachers, and friends play an important role.

In a study of 11-year-old students, boys were five times more likely than girls to express interest in how cars work; boys were also over thirty times more likely to have a fascination with rockets and space travel.[9] Often children are "given 'gender-appropriate' toys, based on assumed sex identity; girls are treated as more fragile than boys."[9] Also, girls are "not encouraged to find out how their toys work by taking them apart, thus losing a valuable opportunity to develop mechanical inquisitiveness and skills. By third grade, girls have been conditioned to accept toys as they are and not try to manipulate or change them."[11]

Comparing male and female engineering students provides some interesting results. Women engineers are more likely to come from an enriched socioeconomic background and also are more likely to have a parent or close relative in a technical field;[1] this relative often serves as a role model, encouraging and stimulating the youngster's interest in technology. Irrespective of economic status, women engineers as a group have a greater interest in the liberal arts and a stronger belief that an appreciation of the liberal arts is important for engineers.[3] As is the case with the verbal/mathematical gap, these differences are statistical; certainly, many male engineers value the liberal arts.

A survey of male and female engineering students at twenty universities revealed that "women were more inclined to enter the 'humanitarian' fields, such as environmental and biological engineering, while men were more interested in aerospace, electrical, mechanical, and nuclear engineering."[3] Women are more likely to choose fields based on biology and chemistry, subjects introduced in a high school curriculum; these are also the fields that relate most directly to the natural environment. However, electrical and mechanical engineering still are the top choices for both men and women.[9] Female engineering students are also slightly more likely to transfer out of engineering departments. Women who enroll in engineering graduate programs are more likely than their male counterparts to end their graduate education with a master's degree, instead of pursuing a doctoral degree.[9]

Just over twenty years ago the U.S. desperately needed more engineers to help usher in the high-tech, post-Sputnik era. An article by Stanley Robin in 1969 addressed the possibility of women filling part of this need. He argued that the "utilization of the female as engineering 'manpower' is relevant. Females are seen as an untapped and major source of engineers in a perceived shortage of engineers—an undeveloped national resource."[6] Two decades have passed and the language about women in engineering is much the same. Robin's paper went on to discuss many possible reasons for the lack of women in the field. The article concluded that "there is no indication that females in significant numbers will become a source of engineering manpower" and that "in our society, females will compose a minute and marginal segment of engineers. Sources of engineering manpower will have to be found in the male population."[6] This attitude is slowly changing.

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11. Thorsen, "Expanding the Pipeline: The Challenges of Pre-College Preparation," Conference Proceedings, Women in Engineering Conference: A National Initiative, Women in Engineering Program Advocates Network, 1990, p. 82, 84, 85.
12. *Women and Minorities in Science and Engineering,* National Science Foundation, 1990, p. 7.

Structural Notes

The Published Record

Perhaps, the critical reader may comment, the picture painted here is warped by the perceptions of just a few people; that is certainly a possibility. In an attempt to provide "additional data," we perused the annals of Princeton publications to find out what the "objective" person might find about women and engineering.

Each section begins with one or more of these finds which, we hope, serve to provide different perspectives. Some add detail to the submissions; some contrast them; others are entertaining diversions; but all deal with women and engineering in some way—adding color to the picture.

Bylines

The year of graduation (or intended graduation) follows the name of the contributor; students who were graduate students at Princeton have "GS" after their names instead of a year.

The contributor's department also is indicated. Note that the Electrical Engineering department gave degrees in both "Electrical Engineering" and "Electrical Engineering and Computer Science" until 1986 when the Computer Science department was formed and awarded a separate "Computer Science" degree.

Glossary of Terms

A.B. = Liberal Arts or non-engineering student (i.e., can be a science major; colloq.)
B.S.E. = Engineering student (colloq.)
Chem E = Chemical Engineering

Civ E = Civil Engineering
CS = Computer Science
E-Council = Engineering Council
E-mail = Electronic mail
E-Quad = Engineering Quadrangle, name of building housing the engineering departments and facilities.
EE = Electrical Engineering
EMS = Engineering Management Systems
Chem E = Chemical Engineering
Civ E = Civil Engineering
CS = Computer Science
Interactor = Engineering program matching juniors and seniors with freshmen
MAE = Mechanical and Aerospace Engineering
MIT = Massachusetts Institute of Technology
RA = Resident Adviser
SWE = Society of Women Engineers
TA = Teaching Assistant
Userid = ID name required to use computer network

The Letter

To undergrad alumni (similar letter was sent to current undergrad and graduate students) in January 1991.

Why women?

The title of this project implies that women have a different engineering experience; however, if this is an incorrect assumption (another aspect had more influence on your experience or you felt no difference at all), please tell us how you remember your Princeton experience. This project is meant to be inclusive, not exclusive.

What is to be gained by this project?

The goals of this project can be summarized into three general areas:

Raise awareness about women and engineering at Princeton... Ideally, we want the book to reach beyond the E-Quad to the university administration, the faculty, campus organizations, and the student body.

Raise awareness about the engineering school... Most students and faculty members are unaware of what happens "east of Washington Road," and to many, the engineering school seems like its own institution with a different administrative hierarchy, a different range of student activities, and a different academic environment. We believe these differences have had an impact on coeducation at

the E-Quad. A look at these differences can provide insight into the workings of the engineering school as well as the status of women at the E-Quad.

Sensitivity... By looking at the engineering coeducation experience, we can see how attitudes and actions—however subtle—can influence students' perceptions of their acceptance in the academic environment.

To whom will this be made available?

Anyone with an interest in women and the Princeton engineering experience. We are requesting both the *E-Quad Newsletter* and the *Princeton Alumni Weekly* to write articles and run advertisements to notify alumni of the book's publication. Furthermore, the university community will be notified. As this is a non-profit venture, the book will be sold at cost.

What can I do? I don't have the time . . .

We welcome all submissions from general musings to specific anecdotes and conclusions. We also enclose a list of questions you might find helpful. They are only suggestions, and you should not limit yourself to them. The format of the submissions can range from prose to poetry, journal segments to cassette recordings, photographs, art, songs, etc. If it is more convenient, please call us to arrange a telephone interview. All requests for anonymity will be respected. Please pass this on to others you think may be interested in sending submissions, especially those who are now out of the country, who may have changed addresses without updating alumni records, or who switched out of engineering.

Attachment to the original letter:

Women and the Princeton Engineering Experience

A list of possible questions to reflect upon (these are by no means meant to limit you, but to perhaps start a few sparks):

- Why Engineering? ... What made you decide to be an engineer? Did you ever think of leaving engineering? What convinced you to stay in engineering at Princeton?
- Confidence ... Were there any experiences during your Princeton career that shaped or affected your confidence in engineering (positively and negatively)? your classmates' confidence?
- Interaction with others ... Were there any experiences or interactions with faculty, advisers (academic and independent work), administrators, or fellow students that markedly affected your views and attitudes about women in engineering? about yourself in engineering?
- Compared to the life of an A.B. ... How would you characterize and evaluate your relations with non-engineering students? Did these relations affect you in any way? Would you have changed them in any way?
- Extra-Curriculars ... Were you involved with activities that dealt primarily with the engineering school or its students (Society of Women Engineers (SWE), Engineering Council, *The Princeton Engineer*, R.O.T.C., engineering societies or undergraduate committees) or that related to the non-engineering aspects of the University?
- Memories ... Which aspects of the Princeton engineering experience did you consider very positive? in need of improvement?
- Post-Princeton ... What did you do after graduation (engineering or non-engineering work, management, consulting, graduate school, etc.)? What influenced your decision? What are you doing now?
- Miscellaneous ... Feel free to discuss anything about yourself that would provide more insight into your engineering experience (racial or economic background, nationality, high school experience, sexual orientation, etc.).

Acknowledgments

We would like to thank the financial contributors who helped to make this project a reality: the School of Engineering and Applied Science, the Department of Electrical Engineering, the Department of Chemical Engineering, the Department of Civil Engineering and Operations Research, the Department of Mechanical and Aerospace Engineering, the School of Architecture, the Department of Molecular Biology, and the Women's Center.

We are also grateful for the strong moral support and invaluable resources provided by Terry Wintroub, Jan Strout, Hal McCullough, Bradley Dickinson, Mahlon Lovett and the Office of Communications/Publications, Allison Jackson, the Mudd Library staff, Kennedy Lemke, Naoma Dorety, Vanessa Carter, the *Princeton Engineer* staff, and Yumi Ijiri. To Pat Coen, we give our sincerest thanks for responding to our various demands on her as editor, non-engineering critic, and comforting e-mail buddy.

After the many months of compiling and editing submissions, soliciting funds, answering questions, and conducting as well as responding to interviews, we often found ourselves steeped in self-doubt: Lost in the "busy work," we sometimes caught ourselves wondering, was the subject of "women in engineering" such a big deal? Were we, by spending so much time on it, making a mountain out of a molehill? What did it matter what women in engineering thought? What did it matter what anyone in engineering thought?

In these times, we were constantly bolstered in confidence by our friends and colleagues who continued to be interested in discussing the subject and cared about the results of this project even when we fell silent. To them we owe our thanks, for without their caring, we truly wasted our time.

We are tomorrow's past.

—Mary Webb

An Engineering Grab Bag: Perceptions and Self-Perceptions

The South produced statesmen and soldiers, planters and doctors, lawyers and poets, but certainly not engineers or mechanics. Let Yankees adopt such low callings.

—from Margaret Mitchell's *Gone With the Wind*

IMAGES OF ENGINEERS HAVE CHANGED OVER THE COURSE OF HISTORY, FROM THE ROMAN MILITARY ASSISTANTS TO THE SPACE-RACE HEROES. HERE WE HAVE INCLUDED COMMENTS ON ENGINEERS AND THEIR VIEW OF THE WORLD—SERIOUS CONTEMPLATIONS, ZEALOUS DEFINITIONS, AND A FEW JIBES, JUST FOR FUN.

The Published Record...

From "From the Editors," *Princeton Engineer*, March 1942

Gentlemen: With half the world in flames, contentment and brotherhood run rampant on the Princeton campus. In every other citadel of learning, engineers roam the campus in packs, held by a tie stronger than love—an overpowering sympathy for those who share the burden they all have chosen to bear. They throw tempestuous flunking out parties for their fallen friends and as the group dwindles to a hardy few, they focus their rheumy mind's eye on that far-off day in June when—well, when they will probably join the army under the "gut-hopper's" heel. But in Bataan or Baton Rouge, they are still engineers; their song is clearer, their women lovelier, their liquor straight. And they can lick their weight in wildcats, because, b'gawd, they passed engineering.

From "Advice to a Fellow Female...," *Princeton Engineer*, April 1949

So, you've got a date with an engineer. Well, you'll have your hands full! Even though they resemble normal human beings at first glance, I'm sure that somewhere back in Paleozoic history, Engineers branched off from the Homo Sapiens line to form a species of their own.

The first thing you'd better do before that date is to look up our dictionary of Engineering terms. I think we still have it in our house files. The girls have compiled it over the years, and we still add to it. You can date an A.B. or even a

pre-med and rely on your native intelligence and get along pretty well. But you'll need a whole new vocabulary for a date with an Engineer.

I realize that you've never heard of a Geiger machine, but you will—about seventy-eight times. You may think that you mastered a lot in your high school chemistry course, but that's the multiplication tables when you're out with a "Chem." Even though your brother flew a B-24 during the war, you'll never be able to discuss planes with an "Aero" without a refresher course in Aircraft Components. It's much safer to stick to football. But perhaps if you concentrate very carefully the first thirty times a steam turbine is explained, you may get the general drift by the thirty-fourth.

Be sure to find out what department your date is in. He's nothing so simple as an Engineer. He's not a Civil Engineer or a Mechanical Engineer. He's a "Civil" or a "Mechanical," or even a "C-he-E." You'll soon get used to it, my dear. Don't worry. And don't be alarmed if he throws you a curve and says he's an Electrical Engineer with a Science Option, Physical Division.

Oh, you'll have a wonderful time on that date. Just don't get ready too soon. When he says eight, he means eight-thirty (like any normal male). He'll give you the thorough "once-over" as you descend the stairs, but don't give it a second thought. He's just used to surveying!

Be sure to wear something versatile. No telling where you will go. But you can probably cross off an expensive evening. (He spends all his money on graph paper). If it's a movie he decides on, he'll explain that television will soon take the place of the motion picture, and proceed to explain how television works, of course. Act interested. It can be fascinating. Or maybe he'll choose to play a little golf. Engineers are always athletic. I think perpetual motion must be contagious. If he tells you your stroke is not "plumb," it only means it needs improvement. Engineers are always good dancers—especially Aeronauticals. They fairly soar, but it's a little hard on the feet. I asked one once if he set his dance steps down on paper along with other complex drawings, but I didn't get a very satisfactory answer.

He has probably left his dagger-like slide rule at home (they really aren't very good protection no matter how sharp they look), but he'll have his gift of gab along.

He studies, but not as much as he'll make you think he does. Thermodynamics and Reinforced Concrete may be "rough," but he does most of his heavy reading on the sports pages. True, his labs last all afternoon, but wouldn't you have fun mixing fluids together in little bottles or examining rocks? I would. He may sketch a wicked vapor pressure curve, but he does a good job of doodling and Varga girls too.

But at any rate if you start getting serious, you'll be glad to hear this. Dr. James F. Bender, Manhattan psychologist, tells girls that an Engineer is the best matrimonial risk because "he's apt to be a stable person who has studied the situation beforehand and knows what he's about." And then, of course, you never can tell when a geological engineer might strike oil or a metallurgical

engineer might find a gold mine. But on the other hand, it's a fifty-fifty chance, and remember this: I can always say, "I told you so."

From "My Slide Rule and I," *Princeton Engineer*, October 1950, p. 15

By the beginning of my sophomore year I felt that the moment had arrived. There was now a real reason for a better slide rule. I was a sophomore. Besides that, I was in a department. No longer was I just an engineer, but a particular kind of engineer. I had a title.

My parents gave me their blessing, and I made my way diffidently to the U-Store. The dreamed of moment had at last arrived, but everything seemed so matter-of-fact. I wish I could say that the purchase was accompanied by thunder and lightning, or even a small ceremony. There was none of that; the clerk was bored and I had trouble remembering my U-Store number.

But now she was mine, all mine. I carried her back to my room, gently. Somehow, I had to indicate my possession. Her cool, well-etched features resisted every attempt short of corporal punishment to leave any sign of my authority. I had to settle for putting my initials inside the leather case. In washable ink, too.

As I look back on those first few days, I'm sometimes sorry that I didn't enforce my authority. You see, I'm not sure now who's boss. I've gradually mastered her secrets—I know that [the various functions] do more than impress A.B.s and inquisitive dates.

But as I've learned her innermost secrets, I've found myself becoming less and less independent. When I try to remember when I first noticed that, I recall a classroom reverberating with howls of anguish when the professor announced a spot quiz. Like men clutching for straws, half a dozen of us smugly announced that we hadn't brought our slide rules. We were grimly informed that a good engineer didn't forget his slide rule, and even more grimly, we took the quiz.

Things like that can leave a permanent mark on one. Since then, we've become almost inseparable. I don't mind that one end of the slider is split a little, and she apparently doesn't mind being dropped once in a while. Though we each have our shortcomings, we're tolerant. I know I can't expect more than three-place accuracy from her, and she knows that I can't set those numbers around 8 and 9 with as much accuracy as she'd like.

This may seem like an idyllic sort of existence, but recently, a shadow has fallen across our life together. Upstairs in room 303 of the Engineering Building, there sit a brood of calculators. They hold a certain fascination for me, with their cool green and gray colors and row after row of buttons. I hate to bring my slide rule into that room, for her pale ivory palls next to the computers the way a housewife fades before Betty Grable. They flaunt their accuracy at me the way any wanton would. I can see them saying, "You won't have to settle for three place accuracy with us. We will do anything you want us to do, and our accuracy is limited only by yours."

[In the Computer Age] I don't know if my sweet-sounding [calculator] is

passing on just as that earlier slide rule did. When I think cold-bloodedly about it, I think it will. But when I let my engineering sentimentality emerge, I'm not so sure. Then I think of the tests we've been through together, and know we can never part. Besides, a computer can look awful silly with its plug pulled.

From "Coeducation and Change in the Engineering School," *Princeton Engineer*, March 1969, p. 11

Before World War II, the engineering student's curriculum varied little between departments and between schools. The emphasis was on the practical skills that the professional engineer would need. Thus, all engineers had mechanical drawing, most had many hours in the field surveying, and most learned to use the steam tables in their thermodynamics course. This emphasis on professionalism gave us many of our best engineers, but professionalism can be narrow in its perspective and tends to look to the past rather than the future. In fact, the engineer acquired the reputation, deserved or not, that he was too professional, unheeding to all but technical questions and unable to see the humanistic side of the problems he solved. In addition, this demand for professionalism discouraged all but the most determined women from entering the field. The Patterson Report on Coeducation at Princeton echoes some of these thoughts: "Our studies persuaded us of further beneficial influences [of admitting women].... Because women seek somewhat different courses and have somewhat different interests, they tend to distribute themselves among courses and departments differently from the way men students do. The result [of coeducation] would be a shift in the educational profile of the University toward the humanities and arts and away from engineering and the pure sciences. A very substantial number of our faculty view this shift in emphasis as *desirable*."

From "Bucking Career Stereotyping" by Brook Crum, *Evening Times*, Trenton, New Jersey, March 22, 1973, p. 10

"Girls are generally not given proper guidance when it comes to math and science," said Mrs. Sabadell [member of Princeton chemical engineering research staff], who thinks that too often members of her sex are steered away from engineering. Her feeling was substantiated in an interview this reporter had with three first-year undergraduates in the engineering school.

"People told me that I would be a good math teacher," reported Claire Shortall, "whenever I mentioned the possibility of studying engineering."

"No one really encouraged me to pursue the field," said 18-year-old Nancy Munnerlyn.

Mimi Kellog, daughter of an engineer and twin to a brother in her chosen area of study, remarked that she thought it was a natural occupation to follow when growing up, but only recently has she realized that at age 19 she has chosen a "strange profession."

What bothers the girls mostly is the stereotype associated with a woman in

the field—the idea that she has to be ugly and have a dry, humorless mind.

"Students who are not in the engineering school are astounded when I tell them I'm studying engineering. They expect me to be odd," said Nancy Munnerlyn.

She confided that many people tend to think the E-Quad—a square brick structure that is particularly undistinguished—personified the engineer. In other words, hideous and rigid.

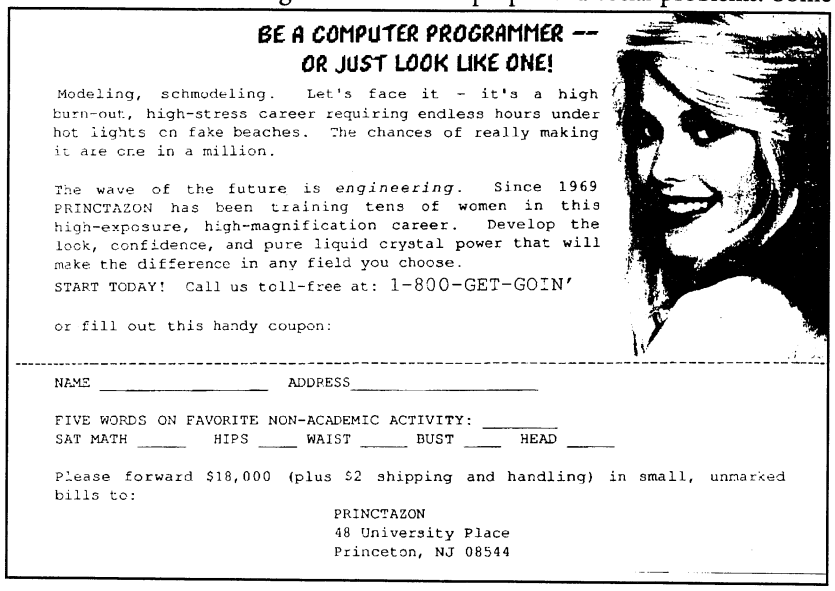
All the girls hope to eliminate the stereotype, which they thought they had left far behind them upon coming to Princeton. Nancy Munnerlyn would like to organize tours [of the E-Quad] for all freshman A.B. candidates next year. "I just want to show the freshmen that this is an interesting place with fascinating people learning and teaching here," she said.

The problem of the stereotype at Princeton is in part due to the fact that the number of women is so small. "The real problem of the stereotype is that it obscures so many of the different kinds of engineering," said Mrs. Sabadell.

Commonly thought of as a profession requiring physical strength, that engineers work solely on road and bridge sites, that the tools of the trade are heavy, dirty equipment, in the reality the profession is hardly so narrow or so rigorous.

"The real tools of the trade are paper and pencil," said Mrs. Sabadell, "and of course brains." Ninety percent of the engineering jobs today are performed in air-conditioned offices.

Psychologists have noted that women look at problems differently than men. And that women show a greater interest in people and social problems. Some



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Courtesy of Tiger *magazine [campus humor], December 1988*

have pointed to engineering fields that they feel are tailor-made for females — design of home appliances, production of food, and processing of fibers.

From the Summer Issue, *Daily Princetonian*, 1988

Dweeb, n. One lacking in the social graces. Every last one of them. See 'E-Quad.'...

E-Quad, abbrev. Engineering Quad, located on Olden Street several light-years from campus. A haven for geeks, with three known computer rooms and several vending machines. See 'geek.'

From *The Student Guide to Princeton 1990*

Engineering Quadrangle: If you're not an engineer, you'll never have to go there. If you're an engineer, you'll never be able to leave. It's located down William Street, which starts between the Chapel and Firestone Library. Call this place the 'E-Quad.'

From *Undergraduate Announcement 1990-91*

Engineering education at Princeton emphasizes the fundamental principles of mathematics and the physical and engineering sciences, and is broadened by substantial opportunities for studying the social sciences, the life sciences, and the humanities.

From *Nassau Herald*, 1991

The five majors in the Engineering School totalled 165 Seniors. The Mechanical and Aerospace was the largest with 51, though only six of these Seniors were women. On the other hand, nine of the 22 Chemical engineers were women. Most of these numbers reflect a moderate growth in all departments despite the complaints that the freshman work discourages many would-be engineers from continuing. The Woodrow Wilson School had 71 Seniors, roughly the same as previous years. Most A.B. students still refuse to understand the motivation for pursuing degrees in either of these schools, however. Of course, there might exist some compensation for the excessive work down the line, but sanity suggests that these people were prostituting themselves to the proverbial rat race.

...Personal Voices

Tanya Furman '82, Civil Engineering

I don't usually respond to surveys, and I typically shy away from "Women's Experiences," but I'll kick in my two cents. The single best decision I made during my educational career was to join the engineering school at Princeton. I transferred to civil engineering in my sophomore year after flirtations with

politics, African studies, and the pre-med arena. My decision was based primarily on the attitudes of the students towards one another and towards their work, which, I soon learned, came across at all levels from deans and faculty on down. Virtually everyone with whom I had contact was interested in gaining and sharing knowledge. Intellectual curiosity was encouraged and rewarded above all else, which meant in part that problem sets and ideas were collaborative rather than competitive. I found this attitude a welcome change from my liberal arts contacts and experiences.

After graduation I did my doctoral work in geochemistry at MIT, and I am currently an assistant research professor at the University of Virginia. Here I try, with mixed success, to encourage the curiosity and attitudes towards learning that I gained at Princeton. I am struck here, as at Princeton, by what I perceive as a greater maturity and confidence among the engineering students. These young people are not simply or smugly headed for "sure thing" careers—they have learned how to apply themselves diligently and in an organized fashion to their academic tasks.

I often joke about my graduate student days as the "process by which I became a man," meaning I learned to compartmentalize both at work and at home. I realize, however, that this process is healthy (in moderation) and the seeds were sown at Princeton. The engineering curriculum taught me the joys of task completion in a way that my liberal arts counterparts never experienced. I feel strongly that I left school better equipped for life in general than they did. Conceit, perhaps, but mostly gratitude.

As a woman (white, if it matters), I gained tremendous self-confidence from being in a collaborative environment. My friends were both male and female, and contacts revolved around scientific questions rather than appearance or sexuality. Overall, Princeton taught me that I really could do anything I put my mind to, that it is okay to struggle with a new problem, and that it is also okay to ask for help.

Sally Blount White '83, Civil Engineering

It is difficult for me to separate my engineering experience from my Princeton experience. While I was there, and as I look back, it all melds together. Perhaps there were fewer women in my engineering courses than in my other courses, but one of the beauties of studying engineering is that there are usually right and wrong answers. If you can solve and calculate the problems correctly, it does not matter what gender you are.

For me, engineering meant learning a rigorous method of thought, which has been invaluable to me ever since even though I have never worked as an engineer! It meant getting deeply involved in research projects with professors, so that I knew what research was about when I decided to enter a doctoral program three years ago. It meant feeling a sense of distinctiveness from the economics majors when I approached the business job market my senior year, because I had more specialized training and a cohesive set of skills.

Because I pursued a joint program in Engineering Systems and the Woodrow Wilson School, I never felt overly constrained by the rigors of the engineering discipline, simply enriched by it. For me, Princeton was where I learned to think independently and to find my own voice. The program in Engineering Systems gave me the room to achieve that kind of personal growth.

Francesca Rago '85, Civil Engineering and Operations Research

One thing that bothered me at Princeton was the sense that the engineers were isolated from the rest of the student body. I can't remember how many times I heard the comment, "Gee, you don't *look* like an engineer!"—a back-handed compliment, at best.

Anonymous '91, Civil Engineering

I see engineering being something more rigorous, more mathematical and quantitative. I have a summer job at NASA doing lunar resource utilization. It's a program in which you can suggest a project, and though I was offered three jobs in geology, I decided I really wanted to do something more engineering-oriented because I lacked those [opportunities] at Princeton.

Engineering [as opposed to science] does something with [geological information]—[for example] monitoring volcanos and setting up a system to take care of the people in the area.

I'll actually be solving the problem of transporting [lunar] mass in a different gravity. This is different from lunar geology which would be investigating what kind of rocks there are, how they form, and what their history is.

Jennifer Rexford '91, Electrical Engineering

During my freshman year it was frustrating to have so much work to do, when the liberal arts students seemed to have more freedom. I always took two liberal arts classes each semester, so I think I had broad exposure to the liberal arts, though I wish I could have taken more. It always amused me when people accused engineers of not being well-rounded enough; many B.S.E.s came to Princeton so they could have the liberal arts exposure. I knew many engineers with diverse interests and activities.

It's funny sometimes to be an engineer in a liberal arts class. Most of the time it didn't matter, but I had a few preceptors who made interesting comments about it. One time I wrote a paper in a Russian social history class; the preceptor liked my paper and commented, "It's so nice to see good writing from a student at Princeton, especially one who has chosen engineering for a career."

Another example occurred my junior year when I took a women's studies class. On the first day, we each introduced ourselves by stating our name and major; everyone else in the class was studying English, history, or politics. After class, the professor came up to me, folded her arms, and said, "Jennifer, you have a very unorthodox major."

Then there was the time I took a poetry class in creative writing. The

professor commented on my choice of major: "Oh, how curious. How ever do you write poetry? Do you hide behind a turbine engine?" I decided not to tell him that, as an electrical engineer, I knew absolutely nothing about turbine engines!

Anat Shiloach '91, Chemical Engineering

I'd like to write something more creative than simple paragraphs, maybe submit a photograph or a poem. But engineering, I've been told, is an activity that excludes such creative ventures. When I interviewed for an introductory photography class I was asked, "What does chemical engineering have to do with photography?" I tried, unsuccessfully, to explain that for me chemical engineering has precisely nothing to do with photography (not being particularly interested in the technical aspects of the film and the chemical development process, which are certainly chemical engineering concerns), and that was why I wanted to take the class. Photography was one of my interests and the class would give me a break from technical courses. Being a chemical engineer, or studying chemical engineering, should not preclude any other activity, no matter how remotely related. Engineering is just one of the things I do—it's not everything I do. And although the approaches engineering has taught me may rub off on other things, engineering does not affect everything I do. But the photography professors didn't seem to understand.

I don't like generalizations. I try to avoid them as much as possible. I have too often been outside the group to which the generalization applies. That's why I'm reluctant to say, for example, that an even male to female ratio improves class relations for engineers. I prefer to limit the reasons for my generally positive experiences as a woman engineer to the specific people I happened to interact with.

I'm too confused about a lot of things to say anything coherent about them. I mentioned the wall between engineering and the creative arts, but at the same time I enjoy belonging to the distinct groups of engineers—chemical engineers and women engineers. I enjoy belonging to these groups, but I don't like the barriers that friends who aren't engineers put up between themselves and engineers, and the assumptions they make about us. I don't have much of an opinion about many women's issues in general, but having women engineers as friends has exposed me to ideas that I've probably (subconsciously) adopted. I'm glad to have been exposed to them, though. Finally, I mentioned that engineering is not everything I do. But through its form and its content, and the lifestyle it's made me follow, it probably has permeated many levels of my life. It's difficult to track where all the engineering pieces landed and what influence they've had. I just feel like I'm missing a lot.

Sally, Me, and the B.S.E.

with apologies to Dr. Seuss and serious poets

The sun did not shine.
(It was a New Jersey day.)
So we sat at the table,
Just rambling away.

I sat there with Sally.
We sat there we two,
And I said, "I detest
The recession, don't you?"

"So few jobs in the country
And so little preparation.
When we leave Princeton's bubble,
Will we have a vocation?

All we do is
Read
Heed
Talk
Walk
And write.
Will we survive a real-world's week night?"

And then
Something went BANG!
How that bang really rang!

We looked!
Then we saw him come in with his tea!
We looked!
And we saw him!
The creative A.B.!
And he said to us two,
"Why do you sit there like that?

"I know times are tough,
And there's not much about
(Especially for A.B.s)
But don't fret and pout!

"I know what you need,"
The A.B. went on,
"Take a good course
Like art or econ.

"Don't let things get you down,"
The wise A.B. said,
As he sat himself down,
And tilted his head.

"This is *your* time
Your time to grow...
Your mother would want you to do so,
You know."

Sally and I did not know what to say,
For our mothers were over 6 miles away.

"Smell the roses," he said.
"There are worse things to be,
For example
A workaholic insane B.S.E. ..."

Just then
A tired B.S.E. took a seat.
(He looked as though
He hadn't slept for a week.)

He said, "You know,
I couldn't help hear
The advice that you're giving,
And I think it quite queer,

"That you see us so different,
So far apart —
But with all things considered,
We're of the same heart.

[1] *Junior paper required of all students*
[2] *Senior thesis is a year-long project required of all A.B. students and some engineering majors.*
[3] *Professor Maitland Jones teaches the organic chemistry course.*
[4] *National Engineering Week held every year in February.*
[5] *"Into the Sunlit Splendor: The Aviation Art of William S. Phillips" on loan to the engineering school from the National Air and Space Museum for 1991 celebration.*

"You imply I'm a grind,
A neurotic of sorts,
But the demands of this place
Are a matter of course."

And the B.S.E. smiled,
And he said with some glee,
"May I point out, for instance,
The famous JP?"[1]

Then he leaned back,
Folding his napkin with creases.
He added, "And of course,
Don't forget senior thesis.[2]

"To get through this place,"
The B.S.E. said,
"We all are required
To use the old head.

"You see, my face is distraught
From much more than sleep,
For upon me a query
Constantly creeps:

"How to use it all?
That's what I want to see.
That's why I'm here,
And not MIT.

"Is there a link?
I want to know,
'tween Milton the poet
and Maitland's Orgo?[3]

"Is there a way
That I can maintain
Simultaneous love for art
And a plane?"

"Yes," I jumped in,
Nearly out of my seat,
"Did you see the display
For Engineering Week?[4]

"Painted by Phillips,"
(I regained my chair.)
"The planes are dramatically
Portrayed in the air!"[5]

"No kidding?"
The B.S.E. said with surprise.
"Really?" the A.B. said,
As he widened his eyes.

"Perhaps," I replied,
"It'd behoove both of you
To share with the other
What each of you do."

The A.B. then said,
"You've made quite an impression:
I'd never pegged you for
Linking your lessons.

"Who would have combined
Art and planes so together?
Now I wish I'd the background
To know fluid flow better."

"You certainly can
Understand fluid flow.
You just need it explained
In terms that you know.

"Let me also express regret
For the comments I've made,"
The B.S.E. confessed,
"About making the grade.

"It's easy to be spiteful
When others around
Seem to have fun
Without feeling bound:

"Bound by sets, bound by labs,
It's easy to regret it,
But (let's be fair) the thrill
Makes us forget it:

"The thrill of team projects
Coming together,
The thrill of insight
That makes something run better.

"Sometimes I wish,
After all these E-capers,
I could do the same thing
With my literature papers.

"I'm sorry for the cuts,
And unkind insinuations
And respect you for
Your careful contemplations

"And appreciation for 'life'
(Whatever that proves to be,
For Princeton's fine bubble
Keeps us quite free

From the outside world
With its unprotected bent,
From practical concerns like
Plumbing and rent)."

Then the two students shook hands
And went on their way.

Sally and I
Did not know what to say.
What just went on?
Was it a battle of two?
Or were more students out there
Just awaiting a cue?

To hurl out once more,
Insults like darts?
And continue to keep
Forcing people apart.

Perhaps I've insulted more
By writing this time
And contorting the picture with
A Seussian rhyme.

But though things are simplified
And portrayals askew
Does that mean the message's
Completely untrue?

Up till now,
Dear Sally has said nothing at all
If you were in her shoes,
What's the decision YOU'D call?

— *Yvonne Ng '91,*
Mechanical and Aerospace Engineering

Anonymous '92, Computer Science

I'd like to see a lot of the misconceptions about engineers changed, but I don't think that it's going to happen. Liberal arts students will always make fun of us for being geeks, and we'll always make fun of them for having no work.

Susan Ipri '93, Mechanical Engineering

The majority of my friends are engineers. Last year, I lived in a quad with two engineers and two A.B.s; the A.B.s seemed to have more free time, depending on the major. I can't say who worked harder or had more time commitments: readings are very different from problem sets.

I have to say that engineers usually have very intense personalities, and the five class requirement tends to keep us that way. Life is different as an engineer; we're a different kind of people, more inclined to do problem sets and such.

Jennifer Leslie '93, Mechanical and Aerospace Engineering

It's hard. Sometimes when I go to Women's Center activities, I feel that I can't talk as well as someone who is, say, a history major who knows a lot more of American history. I'll feel that I have the lower hand.

There was one funny incident, though, when I was at a Women in Leadership meeting and we were trying to get Prospect House for a big dinner. It was the same

day the physics department had their big annual dinner. One of the organizers said, "It's going to be boring anyway, why don't they give the space to us?"—saying, of course, that scientists can't have anything that's not boring. A lot of the time, that's the attitude they have—that all engineers are boring, don't care about anybody except themselves, and think they're high and mighty. I have to tell them, look, I'm here, I really care about the issues, too. Maybe I have a different way of thinking, but it doesn't mean that it's any worse or any better; it's just different. That has to be respected.

I don't feel like a stereotypical engineer because I write poetry and am involved in political activities. Yet I'm not a stereotypical activist because I am an engineer. It's hard sometimes because I don't feel completely like one or the other. Some of my friends are anthropology majors, work with the Women's Center and PSAC (Princeton Student Action Coalition) and will be in Terrace [Club] next year—the total [activist] stereotype, not that that's bad, but at least they know who they are and what they're into. I'm glad that I can't label myself, but every once in a while, I wish I could be one solid thing. Despite my differences from my friends, they're open and willing to listen [to my perspective], which is something I don't find very much except at the Women's Center and PSAC.

Melissa Tamada '93, Electrical Engineering

Sometimes it's hard coping as an engineering student. When I tell people that I'm an engineer, they're shocked to death (especially when I say that I'm an EE). *"Really?"* they always say. It's very disturbing.

They crack lame jokes about it, too. They say that I carry a stapler in my bag because "all engineers have staplers in their bags." Maybe I get more of this because I hang out with A.B.s a lot.

It's not really the workload that I find different [between A.B.s and B.S.E.s] but rather the attitudes. When people react with shock when I say that I'm an EE, I used to say "I'm sorry I'm an EE." Now, I cushion my answer with why I'm an EE, etc. Why are they so shocked? Is it because I don't have pimples or glasses? My being an EE is a particular shock to them, because it seems women are not supposed to be in electrical engineering.

Often the E-Quad is "over there," and with four EE courses next semester, I'll probably be stuck there. This consciousness that engineering will take me away from the A.B. world ties me closer to the A.B. world. There are differences, though, for example in the way of thinking.

I helped out with an Aquinas dinner [which was organized by engineers], and I was amazed. We ran on time; we were clean and quick, and the food was good. With ISAP [International Students Association of Princeton], the dinners are very disorganized. I think the reasons for that are our frame of mind. I want to get the task done quickly and optimally, and after that, enjoy myself. But when I work with the A.B.s, they enjoy doing the work slowly. They don't want to be efficient and would rather chat in between.

I've also had people crack jokes about calculators. I was helping an administrator set the table once for an event, and she kept saying, "Oh, are you going to calculate the angles for setting the napkins?" Comments like that indicate that people think engineering is very foreign—people think they can't relate to it.

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—General Motors Advertisement

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To be successful, the first thing to do is fall in love with your work.

—Sister Mary Lauretta

WHAT LEADS A HIGH SCHOOL OR COLLEGE STUDENT TO STUDY ENGINEERING? IN THIS SECTION, CONTRIBUTORS DISCUSS THEIR MOTIVATIONS FOR ENTERING OR LEAVING THE ENGINEERING SCHOOL. SOME DESCRIBE WHY THEY SWITCHED FROM THE LIBERAL ARTS TO THE ENGINEERING PROGRAM.

AFTER GRADUATION, MANY B.S.E.S ENTERED ENGINEERING CAREERS, IN INDUSTRY OR ACADEMIA; SOME TOOK THEIR DIVERSE PRINCETON BACKGROUNDS TO OTHER FIELDS. WHATEVER DECISIONS THEY MADE ABOUT COLLEGE DEGREES OR CAREERS, THESE WOMEN PURSUED THEIR GOALS WITH CAREFUL THOUGHT AND A STRONG SENSE OF PURPOSE.

The Published Record . . .

From "A.B. Majors Become Engineers: Students Cite Variety of Reasons," *Princeton Engineer*, December 1979, pp. 16–17

Every year, approximately 40 Princeton A.B. majors change their degree program and decide to pursue engineering. The motivation for this change naturally varies from person to person, but according to Dean Robert Schaefer who interviews B.S.E. candidates, the major reasons usually fall into one of four major categories.

"A large number cite the options open to them after graduation. Good-paying jobs, graduate study, and other opportunities appeal to them. Another group has been studying theoretical science, pure chemistry, physics, or math, but also is interested in the applied aspects of their fields. At least 25 percent switch for this reason," said Schaefer.

Some students say they switch because they did not sense a direction or purpose in their liberal arts major and want to feel they are heading somewhere, making their time at Princeton "meaningful."

Students in Schaefer's fourth group were always interested in a particular field such as electronics or computers, and perhaps took courses in their area of interest. For many of these students the switch is a paper change only; they were engineers at heart since Physics 103.... "I switched largely because of job opportunities as an engineer," said William Andersen '81. "I like to work outdoors and am enjoying geological engineering, which will allow me to do this work. I would like to open my own company in the drilling or metal exploration fields, which are currently expanding."...

Tanya Furman '82 also switched for practical reasons. As a pre-med, she is taking the medical school requirements, but said, "It is nice to have something to fall back on." She considers geological engineering a "useful major" and was considering becoming a geology major anyway. "I am interested in natural things such as marine biology and am able to combine this interest with technical courses as an engineer."...

Daniel Hammer '82 [chemical engineering] was going to be a chemistry or biochemistry major but decided he was interested in a compromise between theoretical and applied chemistry. "This is the best of both worlds," he said. "I was seeing too many cases of theory that could not be applied in the lab."...

Barbara Hughey '81 switched from physics to mechanical and aerospace engineering [MAE], but is continuing her interest in pure science by involvement in the Engineering Physics Program. She was originally in the program as a physics major taking engineering courses. She decided she would have more time for extra-curricular activities, such as playing the violin, without a senior thesis and junior independent work in the physics department.

Al Escher '82, civil engineering, and Nancy Hendrickson '82, civil engineering, changed to engineering at the end of their freshman year because they wanted to feel a sense of direction in their studies. "I like the basic engineering program because it is much more serious and disciplined than my liberal arts classes," said Escher, who was planning on an economics or politics major. "A job after school is not as important, although subconsciously it is probably a factor."...

Nancy Hendrickson feels even stronger about a directed education. "I wasn't working in my A.B. courses. I was wasting my time. It is stupid to take courses and not apply oneself," said Hendrickson. "I like feeling directed. I like having a reason for taking a particular course." . . .

For Robert Sanders '81, switching into the electrical engineering and computer science department was only a paper switch. "I have always been interested in the subject and had been taking EE/CS courses through my sophomore year," said Sanders.

Si-Yuen Moy '82 also has had a long-standing interest in electronics, and has been an audio equipment dealer for about a year. He was planning to be a math major but had not been doing as well as he had hoped in theoretical math courses.

From "Feminism and Engineering Woes," *Daily Princetonian*, December 14, 1987, p. 4

During an Orange Key tour I was conducting, the mother of a prospective student asked me what, if anything, I might have done differently in my Princeton experience. After reflecting for a moment, I said, "I'm a history major now, and I would never have started out as an engineer." The woman smiled, adding, "Engineering is all math and science, isn't it? I can't imagine what attracted you to it in the first place."

On my way back to Maclean House, I started thinking about just what had prompted me to say I regretted my original plans to be an engineer. It was not the two Cs I earned in Physics 103 and 104, the long hike to the E-Quad, or even the fact that I had to take Chem 205, probably the worst course I have ever suffered through in my life. What really bothered me about my one-year stint as an engineering student was that I wanted to be an engineer for all the wrong reasons.

In high school, I had discovered mathematics, physics, electronics, and computer science were the easiest subjects for me. Although history had always been my favorite class, the other three classes required a lot less work to get an A. I heard that engineers had numerous job opportunities and high salaries, but that there were few female engineers. The few women who earned engineering degrees had their pick of jobs. Okay, I thought: $50,000 a year, two years out of college isn't bad... I'm good in math and science... and if the big corporations want women engineers...

The thought of becoming an engineer also appealed to my feminist ideals. I thought about doing something for the benefit of all women. I would prove the equality of women by entering a field dominated by men.

I entered Princeton as an engineering student, but by midterm break of my first semester, I realized something was wrong. I hated my math and science classes but loved my humanities class on the Middle Ages. In addition, the thought of four years of almost all math and science made me miserable. Even the earlier thoughts of an enormous salary as an engineer lost all appeal. So, I trekked out to the E-Quad to speak with an assistant dean of the engineering school about switching into the A.B. program.

The dean consoled me about my mediocre grades and said he understood how frustrated I felt. But he insisted I was copping out. He told me I did not have to get stellar grades—after all, I was female, and as long as I earned Cs or better, I would get a high-paying job after graduation. He stressed how much easier a career in engineering was for women, since unlike men, we would not have to work very hard at our jobs. Only half convinced, I agreed to stick it out a little longer.

But by early spring semester, I knew I wanted out. To hell with the salary and proving that I was a feminist by becoming a professional in a male-dominated field. I was not going to be an engineer because I hated it and I was miserable. I stormed over to the dean's office, got the degree change form signed and breathed a sigh of relief.

The reaction I received from everyone who had encouraged me to become an engineer was disconcerting. Not only had I given up too easily, they told me, but I had sacrificed my feminist ideals for the sake of an easier course of study. No one mentioned or suggested that wanting to be happy and enjoying my studies might have been a good reason for switching. When I tried to explain my feelings, they only shook their heads as if to voice disappointment with me.

I have only recently shed my feelings of guilt for my decision. Whenever I began to feel relieved that I was studying history, a little voice inside my head told me I had made the wrong choice—I had given up too easily and sacrificed my feminist beliefs. Another voice, however, told me there was *nothing* wrong with my decision: Feminism does not require women to prove their beliefs by doing things they do not want to do. Entering a traditionally male-dominated field is not the only way for women to prove they strongly believe in equality of women.

I have learned that being a feminist means being an individual. It means not allowing society to pressure you into certain roles, simply because you are female. Yes, a certain amount of self-sacrifice may well be necessary to achieve one's goals as a feminist, but that self-sacrifice should not involve being frustrated and unhappy.

I am graduating soon and expect to start graduate school in September; I plan to study medieval English history with an emphasis on women's history. I enjoy what I do, and I continue to believe firmly in feminism. And, because of this belief, I respect those women I know who are engineers. I only hope that they are engineers because they enjoy it, not because they feel pressured to prove their feminist ideals.

. . . Personal Voices

Laura Mancuso '83, Civil Engineering

When I was applying to college I wasn't sure if I wanted to study engineering or liberal arts, so I applied only to schools that were strong in both—Princeton, Brown, and Duke. I had the *ability* for math and science, which is all you know about engineering in high school, but I knew there was potential for me to decide to major in either liberal arts or engineering. When engineering is one of your choices, it can be hard to keep your options open.

With engineering you have to get started right away, in the freshman year. The year I applied to Princeton was the last year you could apply as "undecided" between engineering and liberal arts. After I decided to attend Princeton, I was pushed to make a choice. Since it is easier to switch out of engineering than into it, I started out as an engineer.

My freshman year I found myself behind the eight-ball in math and science because of my high school background. I had attended an all-women's school. Although my math and science preparation was not as strong as it could have

been, I benefited from attending an all-female school; it gave me an excellent attitude about women. Women ran the school. The question "What can I do as a woman?" was never relevant.

During the late '70s and early '80s there was a wave of enthusiasm about engineering. Silicon Valley was starting to boom; engineering was glorified and admired. It was assumed that if you had the skills to be an engineer, there was absolutely no question that you should do it. I felt a lot of pressure to stay in engineering. There were some really tense moments. At the end of my freshman year I decided to switch into the psychology department. I went to see my adviser and he said, "But you made it through freshman year! That's the hardest part." My family felt much the same way. They were proud to have a child in engineering.

I struggled greatly to reconcile my interest in psychology and my ability to "do" engineering. From that point on I started looking for compromises. I wanted to pursue an interest in human values and emotion but also keep the analytical aspects of engineering. My compromise was to major in Engineering Management Systems, complete the Program in Science in Human Affairs, and write a thesis on "Human Factor Needs of Novice Computer Users." When I was in college the personal computer industry was just starting to enter people's lives; human factors engineering sounded like an interesting way to bridge human emotion and technology.

In a way, it's good that I went to a place like Princeton, where I could develop my interest in liberal arts. I have been living near MIT recently and I think that if you focus just on solid engineering you are really missing something. At Princeton I was involved for several years in Peer-to-Peer Counseling. The program was excellent and had incredible training sessions. I was also president of the Engineering Council during my senior year. We organized a conference on technical relations between the United States and Japan; that was just becoming a hot issue.

After college I joined a marketing training program at Hewlett-Packard in Silicon Valley. Trying to find the most "humane" part of engineering, I worked in business systems designing courses to teach people how to use computer products. After working for two years as a systems engineer, I took a huge pay cut and switched to a community mental health agency. I obtained a master's in psychiatric rehabilitation and have been working in the mental health field for six years.

I still find my engineering background useful. An engineering education burned circuits in my mind for problem-solving. I often find myself using technical analogies in solving nontechnical problems. An engineering background teaches you to state your assumptions, decide what type of model to apply, and attack the problem. It gives you a valuable framework.

It's hard to stay in touch with Princeton, since my life now is so different than it was when I was in school. I went through my four years as an engineer, but now I do something completely different. My main link to Princeton is mail

from the engineering school, but all it does is reinforce that engineering is not me anymore.

The best part of my Princeton experience was my roommates. That's the most important thing to me—the friendships. The seven of us just got together recently. We still keep in touch, around the world.

Shara Lewis '85, Civil Engineering/Architecture

My godmother was an engineer from MIT when there were few female graduates from that institution, and she encouraged me [to go into engineering]. I had an early interest in math, but decided to study engineering because I thought it was not as "academic" as pure math.

Since I lived in the Boston area, I didn't want to go to Harvard. When I visited Princeton, its beautiful campus struck me. It had a good engineering program and a gymnastics program. I was hosted on that trip by a woman on the gymnastics team who was an engineer. She was fun, pretty, and not a stereotypical engineer. I'm sure that was another influence. When I was accepted to Princeton early action, I decided to attend.

I feel that a significant aspect of my Princeton experience was the people I met and the friends that I made. My Princeton friends were intellectual yet humorous, liked sports—I'm sure they worked hard but they played hard, too.

I was originally an MAE, but my sophomore year I became interested in architecture. Professor Billington's course was especially inspirational during this time, and I decided to switch to the civil engineering program so that I could combine my interest in engineering with architecture.

At Princeton, I was most happy working with people like Professor Billington who had an interdisciplinary approach. I was able to take "fun" engineering courses like the seismic course—these kept me going and made me happier with my choice of major.

I did think of leaving engineering, but my mother convinced me to stay. A lot of courses were required of engineers, especially those in the architecture program, and it was difficult [not to get discouraged] when I saw many of my friends (who were not engineers) having an easier time. I wasn't sure I wanted to be a professional engineer.

I realized, though, that I could always decide *not* to do engineering later, but that I should keep the options open by getting the B.S.E. My mother was a great influence on my decision to stay. She had grown up in Britain where she lacked the opportunity to study science, and she wanted her daughter to have that opportunity.

Now that it's five years later, I'm glad I did it. I had felt that I was missing out on a lot before; maybe I would have been able to improve my other skills like writing and analytical thought if I had taken more humanities courses. I still feel strongly that the engineering advisers should push students to take as many different courses as possible.

Jackie Holen '86, Civil Engineering

I became an engineer for two reasons: ignorance and tenacity. In high school I excelled at math and physics; and, not really knowing what engineering was or what engineers did, I thought I wanted to study engineering. In my first semester at Princeton, I realized how poorly prepared I was in physics—my high school class was nothing compared to Physics 103! Of a year's worth of 10-point quizzes in the Physics 103–104 section, I received one 10, more than a handful of threes, and averaged about a five. This experience proved both humbling and frustrating, but I doggedly continued, adopting the motto "I refuse to believe that I cannot do this."

I did pass the physics sequence and became increasingly less alarmed in science or math classes in which I did not feel I had mastered the material. But I definitely lost a good deal of confidence, and throughout my undergraduate and much of my graduate school years I felt that I never really "got it," that I had somehow managed to fool the professor and award-givers into believing that I was smart. I managed to get some good grades, won a couple of awards, graduated from Princeton summa cum laude, got into graduate schools, went to Stanford, won fellowships, received a masters degree in a field of engineering other than my undergraduate major, changed fields again for my Ph.D. work, and *still* felt I was fooling them. Recently, having begun my Ph.D. work, I have reached the conclusion that there is no way I could have gotten this far without a lot of diligence and some intelligence. Besides, I'm getting cocky: If I fooled them this long, there's no reason to doubt that I can continue to do so.

For my first one-and-a-half years at Princeton I was a mechanical engineer. In addition to the trials and tribulations of physics, I found thermodynamics especially difficult. It was not so much the concepts as the applications that perplexed me. The homework problems would begin something like: "Suppose you have blah-blah-blah engine...," and I didn't know what that was. I struggled with setting up the problem and picturing what was going on. The physical processes and the mathematics we were using were not so hard, but I realized how much of a struggle it would be to tackle a subject so foreign to my own background. Feeling like I had failed (whom or what I couldn't say—perhaps my own expectations), I transferred to the least "technical" of the engineering fields, systems engineering (in civil engineering), as it was called then. I vowed I'd never take another lab course and planned to fulfill the requirements with as many economics courses as I could. I also thought about transferring into the history department, which fortunately I did not do.

I spent one semester in systems engineering, but, again, the fit wasn't quite right. I cannot recall why it was I decided to switch, but I returned to begin my junior year in structures and mechanics (also civil engineering). I suppose I was, even then—and since then have become much more so—intrigued by this field that is so closely related to architecture. I had not taken any courses in architecture, but had always enjoyed historic buildings, design, and drawing. (I'm not quite sure why I didn't end up in the Architecture and Engineering program.) Now I could relate to the problem applications. I enjoyed and did well in structural analysis, continuum mechanics, and finite element analysis. I tolerated (and did well in) soil mechanics, geology for engineers (I would have preferred the regular geology course), and hydrology. I developed much more confidence in my abilities and felt like I was finally thriving in my studies.

It was, undoubtedly, the faculty in the new field that made all the difference. The department was called just "Civil Engineering" then, though most of its students were in systems engineering. Those of us in structures found that we had an exceptional student to faculty ratio. Not only that, my interactions with faculty members were encouraging and inspiring. Rarely did I seek a course teaching assistant for questions; the professors were always willing to discuss the material.

Even more important, the professors served as mentors. They took the undergraduates seriously, and I enjoyed discussing their work as I tried to imagine what I would like to do in my own career. Professors David Billington, Robert Mark, Jean-Hervé Prévost, Erik Vanmarcke, Ahmet Cakmak, and Peter Lee were especially encouraging.

Professor Billington, who was also one of my senior thesis advisers, remains to this day an involved mentor and role model. His guidance and help have been invaluable to me, as an undergraduate and ever since. In the late spring of my senior year, I plunked myself down in his office and asked him what I should do with my life. He responded that I ought to apply for a Fulbright and proceeded to outline a strategy to get one.

I spent the year after graduation working in New York, first as a structural engineer, which I found extremely tedious and dull (there they told me I had to pay my dues—but I preferred to seek out more intellectually stimulating dues elsewhere), then as a sort of economists' assistant (it paid the rent). The following summer I was back at Princeton to work for Professor Mark and help out with the Sloan Foundation summer program. Thanks to Professor Billington's assistance, I spent the next year on a Fulbright to Switzerland.

Since then, I've been at Stanford, first getting a master's degree in scientific computing and computational mathematics, and then in the civil engineering department's Environmental Fluid Mechanics Laboratory for my Ph.D. work. Why the changes? In Switzerland I realized that although I love studying structural engineering, I did not enjoy doing it. I had been drawn to structural engineering because it combined both creative design and mathematical modelling. In a professional firm, however, the senior partners and architects seemed to do all the creative work, and no one cared much about advanced analytic techniques we studied in school. I decided I would do better at either extreme: architecture or mathematics. Opting for the latter, I began graduate school at Stanford in the Scientific Computing and Computational Mathematics Program, which is essentially applied math. Although I liked the material, I was not happy in the program, which had only started admitting students the year I matriculated.

I realized that I valued and needed a constructive and supportive academic environment. At this time I also veered away from structures and toward fluid mechanics, which seemed to pose more interesting mathematical and computational challenges (it is also a "hot topic" at Stanford). Armed with the tools of applied mathematics and numerical methods, both of which are extremely useful in all engineering fields these days, I set out in search of dissertation research in various departments. I was guided as much by desire to find a supportive adviser with whom I would work well, and fellow students who were bright and fun, as by interest in the actual research project. I found both great advisers and fascinating work and am very happy with the choice.

What next? First, get the Ph.D., then continue in academia if the opportunities are good. If not, I'll also consider consulting, research, and/or anything else that seems interesting. However, I would love to teach, to encourage students, and especially women, to pursue studies in engineering, math, or the physical sciences.

Jennifer Haskins Shelamer '86, Electrical Engineering

I had always intended to be a musician, specifically a band director. Somewhere around the beginning of my senior year in high school, I really began observing my band director. He showed up at 7:00 a.m., frequently didn't leave until after 5:00 p.m., and spent every afternoon for the whole fall yelling at students who couldn't get their marching patterns right, out in the hot Florida sun. I realized that this was not what I wanted for my life. I also knew that I did not want to be a performer (I am too social to spend many hours a day practicing piano, and I don't really like traveling).

Since I was good at math and science, I began to look at engineering. My dad had a friend who was in charge of the Robotics Laboratory at the University of Florida, and he encouraged me to spend time in the lab. I quickly fell in love with robots and decided that that was what I wanted to do. (Parenthetically, I have yet to work with robots, although I have remained very interested in robotics.) I thought that I was more interested in controlling the robot than the mechanics of the arms and joints, so I became an electrical engineer.

I never really considered leaving engineering because I couldn't think of anything else I wanted to do, and at least an engineer is assured of a comfortable income. Although I made better grades in my liberal arts classes than my engineering classes, I had the same problems that I had had with music: I didn't like the career options open to me if I pursued those majors. Besides, I could always pursue music on the side; it's much more difficult to pursue engineering on the side if you major in music (maybe impossible?).

I also stayed in engineering because I liked what I did in my summer jobs. I reasoned that although I hated going to school for engineering, I liked what an engineer did, and I would spend most of my life working, not going to school. If my summer jobs had not been so positive, I might have made another decision.

It was these jobs that really shaped my confidence, rather than the classwork. Although I left Princeton with a good GPA, it was mostly because I made very high grades in liberal arts classes to balance the mediocre grades I made in engineering. I didn't do poorly in my engineering classes, but like most Princeton students, I had been at the top of every class in high school, and it shook my confidence to be nearer to the middle than the top.

Anonymous '91, Civil Engineering

I switched into the engineering program sophomore year. I had been taking a science curriculum and figured with a few more courses, I could have a more usable degree. I'm planning on getting a Ph.D.—maybe in engineering, maybe not—but I figured that I'd be able to take a few years off after being an undergraduate and work without needing a higher degree.

I don't know what I expected from college at all. So far it's been great. I feel that I didn't come prepared from high school, but now I feel prepared for learning on the job and things like that. That's my only expectation from an undergraduate education—it should prepare you and expose you to a broad range. Within my field, I feel I've been exposed to a lot of different areas.

I've gotten to travel an awful lot, all in the name of geology: trips to Hawaii, Venezuela, Montana. Aside from going to all those places and meeting other students who are interested in the same area of geology, seeing something different—a different way of life—will, I hope, keep things in perspective.

Jennifer Bonini '91, Civil Engineering/Geological Engineering

Since I have two older brothers who are engineers and a sister in science, I had a lot of exposure to engineering while in high school, unlike most of my classmates. I had always been very science-and math-oriented, so I knew that was the direction I wanted. When I applied to schools, I looked at them based on their engineering programs.

I ended up being admitted early. I applied here and to Stanford as my top two choices, and I got into both. My decision literally came down to flipping a coin. After a lot of thought, I decided that I couldn't go wrong with either place. I felt more secure about Princeton's engineering school since I knew more about it. The history of my family at Princeton was another factor in my decision. If everyone was coming home for Reunions, I would be missing out on a part of understanding my family and having that common experience.

Going to Princeton has been a real learning experience. It's neat that all of us are Princetonians, but I had a hard time coming into it, especially since I was following footsteps that were really big. My brother Jamie did outstandingly here—above a 4.0, acing the place.

[While at Princeton, my brother] did nothing but work. I came in here with the attitude, "Well, if Jamie can do that, I'll be able to have fun *and* do well." Due to our different experiences leaving high school and such, I didn't have the intensity that he had when he came in.

I made a strong effort to find my own niche here and to find what it was I could do really well, which turned out to be very different from what Jamie did; for as much as we're alike, we're also very different. That, in itself, was a twist that was different and hard to deal with for a while.

For me, freshman year in engineering was not the best experience at all because I was the only engineer in my seven-person suite and I knew very few other female engineers. In terms of grouping together, I had a lot of male friends who were engineers. In this, guys have the advantage. Since there are a lot more male engineers, there are a lot more of them who are roommates or who form a close-knit group of friends within engineering that they can draw from.

Women don't have that advantage, and I felt very isolated, which made it hard to connect to the system; it would have been nice to have had the support of another engineer. That's where my friend Lisa fit into my life. Sophomore year, we were both engineers. Everyone finds their niche of friends, but you really do need to have a group of friends in your academic community.

During freshman year, you're taking physics, chemistry, and math. You're not taking courses in engineering, the reason you were excited to come here in the first place. I remember freshman open house [at the end of the first year] when they were taking us around labs and showing us these neat things. My friend and I were running around the E-Quad saying, "This is so cool! *This* is why we became engineers." We'd missed that freshman year. While we were taking three science courses, everyone else was finding out about Princeton, but without the workload that bears down on you. Being somewhat isolated from other engineers makes it really hard to stay excited, and that's probably why I found a lot of people dropping out and leaving engineering before they even got into engineering. You don't get into engineering until the end of sophomore year, beginning of junior year. Until then, you just have these huge introductory courses.

One reason I liked the combination of geology and civil engineering was because I had experiences with both departments. First there were two years of my "engineering days" when I was in the E-Quad a lot and wasn't really anywhere else. Then junior and senior year, I became more and more a part of the geology community, which I absolutely loved. It's like a family—a small group of people who are really interested in the same type of thing.

During the day, the faculty members are around, and the structure is arranged so that you can always see faculty near the mailboxes and talk to them when they come in. It is a really great place that you can feel you're a part of. To me, that's one of the key things about being happy in a major—feeling that you have a support network and that you have your own niche, your own place. People know your name and who you are—you're not just one of many science majors.

Actually, I was not going to take a geology course because my father is a geology professor here and I didn't want a conflict of interests. However, he went on sabbatical one year, so I decided to take a geology course. I ended up getting a summer

job with a company and worked with a geological engineer and a geology major.

Through that experience, I found out about geology. Although I wanted to stay in engineering, the science side interested me, so I decided to do geological engineering. I surprised my dad when he came back, though. My interest in geology was completely unexpected; had he not gone on sabbatical, I probably would have gone away from geology completely.

So many people I've talked to who are now juniors and seniors say "Wow, I wish I had known about geology." Geology is one of those things people don't know much about, but it affects everything. It's one of these sciences where you can have math, physics, and chemistry involved in one thing. I can take geophysics or geochemistry, and I'm not giving up an understanding or a desire to learn more about these things. Petrology is chemistry, but it's also flow dynamics and fluid mechanics. There are all these disciplines that are involved in the area, and people don't realize how exciting a field it is. I think I made a really good choice. I hope other people have that opportunity in the future.

Robin Katz '91, Civil Engineering and Operations Research

I went into engineering for a variety of reasons: I was good in science and math, and I thought it would be easier to get into an engineering school rather than a liberal arts school, especially since I was always hearing "we need more women."

Engineering was appealing because it was practical and I could do something with it. Also, women weren't in it, and I might have wanted to prove I could do something about it.

I was going to apply to U. Michigan, Cornell, and Princeton, and Princeton was the only one that I applied to for early admission. I didn't want to write any more essays, and Princeton had the most. I figured that any school was pretty much the same, and I was thrilled to be getting out of the Midwest when I was accepted by Princeton.

Looking back now, I was too harsh on my high school friends who didn't try to "get out" [of the Midwest]. Now I see that there was more of a trade-off than I thought at first. I sort of had a chip on my shoulder coming out of high school, feeling that my classmates didn't go as far as they could. I didn't realize they traded off priorities. My values have changed since then. Now I wish I could have been closer to home, so that I could see my parents more often than one week out of the year. At first it was uncool for parents to visit, but now I wish they would. I'm proud of them.

Sophomore year, I saw people dropping right and left out of engineering. I used to call my mother a lot then, and she'd always remind me where I was and ask me what it was I wanted.

I had scholarships from Society of Women Engineers and other institutions, which gave me a lot of confidence, but I was not prepared for physics and the other college courses. My B.S.E. adviser was not very good and gave me no

warning that I was in way over my head in my classes. He didn't have a good perspective of the level at which the courses were taught.

I switched [from EE] into civil engineering because it was softer and less technical. It had more room and flexibility for courses like economics. With EE, I felt locked in. In hindsight, it's a shame that I changed because I really love building devices. Physics made me switch from EE since I wasn't doing well in it. In a sense, I wanted to have the [engineering] degree but not to work for it. I wanted to take as much outside the department as possible.

Engineering became my default major. I have no confidence in my creative ability, and engineering didn't demand creativity: I have no talent for bullshit and I found engineering to be a direct field. Doing engineering work, you show how your thoughts go, why you thought that way; there is only as much room for interpretation as you want to leave. I liked the lack of ambiguity, and engineering was good for my knack for math.

Sophomore year I was going through the motions of being an engineer, but I wasn't interested in the subject until senior year. I learned skills, though, which will be useful anywhere: working hard and solving a problem by looking at it as a whole.

I'm never going to regret my engineering education although I'm totally switching fields. I went into the program for the wrong reasons. First, I was going to go all the way to a Ph.D., and second, I wanted to prove something about being a woman.

[Instead of working as an engineer,] I'm going to be doing outdoor education. I like it and I think I'll be good at it; education is not ambiguous to me. People can never hurt from learning more or from feeling good about themselves. A lot of the meanness in the world comes from insecurities.

I don't know of many other engineers who are drifting [away from engineering] like this. Luckily, I have no loans to pay off; if I did, I'd probably have to change my decisions.

In the EMS program, money is the bottom line, and that doesn't fit into my values. No professor except one addressed education as a viable professional field. For all the rest, money was the main motivator.

I'm having trouble accepting positions or careers that aren't black and white. Even the Peace Corps is not a clear option. One would think that we civil engineers just make things—roads, bridges, sewage systems—to help people. How can that be unclear? But how do we know we're doing the right thing? A lot of the projects are determined by politics and not necessarily by need.

"What's in it for me?" is the kind of attitude that I find. And the civil engineers who aren't that way really have no control over what they're doing. Sometimes they get wrapped up in the details of the project, not what they are really doing. They do technology for the sake of technology, rather than investigating how to use it best. I have a really hard time with "Just do it" instructions. I don't like that kind of authority; it keeps me from letting myself do well.

Anat Shiloach '91, Chemical Engineering

I did not always know I wanted to be an engineer, or even to study a technical field. In high school I enjoyed English and French classes as much as (or more than) my chemistry and math classes. I had really no idea what engineering was. I was never pushed in either direction by my family or by my teachers, and I chose engineering almost by default—I liked math, I liked chemistry, why not do something practical with them? I had no idea what I was getting into.

I also chose engineering for superficial reasons like the structured curriculum. I remember getting the matriculation information in the mail before freshman year and I couldn't imagine having to choose four or five classes out of the hundreds offered. It seemed much easier to be told I had to take math, physics, and chemistry, and only deal with the freedom of choosing one or two courses a semester. (I hate making decisions.) They were more superficial reasons—I had to rely on them because I didn't find out what chemical engineering actually was until it was almost too late to get out.

I enjoyed the form of study. I liked the finality and the quantitative precision of a boxed answer. I liked arriving at a solution rather than just tossing around handfuls of ideas. And being a naturally quiet (shy) person, I liked the passivity of copying notes from the board in lecture and the absence of precept pressure. (I guess I also have to admit that I liked the idea of being in the heroic, glorious, tiny minority of women engineers.)

Now that I know more about the content of chemical engineering, I still consider the form of engineering study a valid consideration in choosing engineering. Sometimes I think the form is more important than the content—programming is programming no matter what the program is supposed to do. The same fundamental problem-solving techniques can apply to reactor design and process control. I'm an engineer because I like the click of a computer keyboard and the scratch of a mechanical pencil finishing a problem set.

I hesitate to attribute almost any aspect of my engineering experience to being a woman. The rather severe shock I suffered freshman year, not only in physics and in math but also in my French class, for example, is easily explained by my initial over-confidence. My high school was competitive but small, and it gave me the impression that if I worked hard enough I could succeed at anything. I never doubted my abilities to meet any challenges. I came to Princeton afraid of everything but the academics and was immensely surprised to find them much more challenging than anything high school had prepared me for. I didn't quite know how to ask anybody for help, or how to work with other students, male or female, on problem sets. Being one of two women in my Math 204 class might have had some influence, but I think the other factors were stronger.

When I finally learned to ask for the help I needed, I worked with both female friends and male friends. More of my close friends were guys, and I never really thought about the difference in working with them. They were my friends before they were engineering contacts.

Anonymous '92, Computer Science

I came to Princeton as an A.B. candidate, not knowing too much about what engineering really was. I met a lot of engineering majors during my freshman year and decided that I liked what they were doing, so I transferred into the engineering school.

This was a very difficult step for me to take because I hadn't started out taking all of the B.S.E. requirements—I had the joy of taking physics during my sophomore year. I never thought of leaving once in the school, just because I'm not really that interested in majoring in anything else. I was worried that I wouldn't do well, but in my mind, there really wasn't any other option but to stick it out.

I am the type of person who feels insecure no matter how well I do in my classes. I am always thinking that I don't know as much about computers as everyone else in the department, no matter what their GPA. I have also convinced myself that my independent work project is not as difficult or significant as other people's. During sophomore year, I was a basket case. I thought I knew nothing and that all those nerdy guys in my classes were geniuses or something. After a while, though, you figure out that they're just as stupid (or smart) as everyone else.

I am very bitter about some of the advising I received upon first deciding to enter the B.S.E. program. I was very concerned with catching up with everyone else, but some of the advice I received was incorrect and resulted in my losing an opportunity to catch up a little more.

I'm thinking of going on to graduate school in computer science. I've done one summer internship at Bell Labs and am going back there again this summer. Right now, my goal is to become a researcher, but that just might be because I'm too scared of getting a real job and getting up early each day and putting on a suit.

Basically, being a female engineer at Princeton is kind of difficult at first (especially if you're an insecure person to begin with because you don't get too much encouragement from your male classmates; they're basically oblivious). But after awhile, you get used to it, and it's really not that big a deal to be in the minority. Perhaps there are particular situations where discrimination occurs (maybe with an older professor or something), but it's really not like that overall.

I would certainly like to see more women in the school, if only to make the men stop complaining about how there are no girls for them, but I'm doing okay as it is. (That's not the only reason I want more women. It would be nice to have a larger support group here, and it would make the E-Quad more fun.)

Amy Fronduti '92, Mechanical and Aerospace Engineering

I think the challenge was a part of [the reason I chose engineering]. I loved English and the social sciences almost as much as technical topics, but technical courses were harder for me and seemed to push me further. I don't know why I ended up choosing engineering instead of, say, pure science, except that it

seemed more practical—you actually build things.

However, I've thought about leaving engineering a lot. It's not so much the work as the fact that I do love English and a lot of other courses. But I can't think of what I would do with another degree; I would rather be an engineer than whatever I would be with another degree.

I definitely got frustrated. Freshman year was particularly bad, taking PHY 105 and MATH 203/204. I started in MATH 217 and dropped right down. That was a real confidence-buster. After that, I was used to not understanding things right away. Later, I found that I could understand in time. The problem wasn't that the courses were too hard, but the sheer volume was [overwhelming]. I got through it, and I have to say that this year has been better. It's finally starting to pay off.

Junior year is better in terms of volume of work, but I'm not more confident about my major. In reality, I'm a lot less sure about my major at this point, especially this semester: I'm just not that interested in any of my classes, and I'm not sure that I'm learning a whole lot. I feel that I'm just doing the courses that are required of me. I'm just "getting through" them, which is frustrating in a very different sense.

Last term had a lot more work than this semester, but I felt that I was learning a lot; I was interested. That made it easier to be motivated and to do work. This semester I don't want to do the work, but I'm hoping it's just the set of courses that I'm taking, not the major.

For example, we weren't prepared for the project that we're working on this term, not based solely on the class instruction. We have to do a lot of work out of class—which is fine—but we've found that there's not necessarily a lot of information to find. The end result is I spend all my time looking for information, not finding it, and guessing what it should be. I don't feel that I've actually learned something and have applied it. It seems like a lot of hand-waving, and maybe that's what engineering is. People say, "Just pull numbers off the chart," but I hope that's not all engineering is because that's not interesting.

Susan Kim '92, Electrical Engineering

Originally, I was going to go into mathematics; that's why I chose Princeton over Urbana-Champaign. It's sort of random how I got into electrical engineering: I met a math major who completely intimidated me, and I thought if everyone in the class was like him, I should try something else. I had heard that electrical engineering was very mathematical, so I thought I'd try it and see what it was like. Also, part of [my choice] was sort of silly: EE's supposed to be one of the more rigorous engineering fields, and I wanted to see what the challenge would be like.

This is the first semester [junior, spring] we've been doing things that I'm directly interested in. I didn't do really well in EE 390, but things we had done

before finally made a lot of sense in that class. I finally feel that maybe I belong in the department and I can get a good grasp of what's going on.

There aren't many signal processing courses that you take before now—one junior year and one sophomore year, but not much else to give you an idea of what sorts of things you do [as a signals engineer]. I won't *really* know what signals engineers do till next year when I have independent work and higher level courses.

Electrical engineering seems to be split up into all these "pseudo-sciences": Computer engineering is pseudo-computer science, EMD [Electromagnetic Materials and Devices] division of EE is pseudo-physics, and signals is pseudo-math. You sort of flop around between the hard-core science and the application. In some courses, you actually build something. In CS 317, we had something to show for it in the end: I built a remote control and it was so exciting when the little light blinked at nine feet. You had proof that you knew something; it was real.

I sort of developed this strange way of looking at where I fit into the electrical engineering department. It doesn't seem a competitive class but it is, from sheer knowledge of the curve. It's sort of a joke with some of my friends. "Where do we stand on the curve??"

I've had this theory that there are the people who are really bright and don't work hard and the people who are bright and work hard. I'm just kind of there. I don't feel very competent as an engineer, and sometimes it's hard because there are a lot of people that are better than I am but they still don't feel secure. Sometimes I feel that there's a lot of ego stuff going on besides the academics. Since we can't all be on the top, there are people near the top who get worried and that's hard to deal with. It doesn't help when you're not doing well, but it's even worse when other people brag a lot or tease you [because you're not].

It's also tricky because everyone always falls back on it as being a joke. I don't have that problem in just engineering. At my eating club, I know a lot of men but not a lot of women. I'll sit with them and they'll say sexist things. When they really bother me, I'll get up and say, "That really bothers me"—and they'll say, "Oh, but it's just a joke." If it bothers you, it's not a joke. If it's not funny to you, it's not a joke. Then I'm "oversensitive." Gee, you're supposed to feel bad because you feel bad. That's not fair because you're not doing anything, you're just reacting.

I [know] other women who have had a male lab partner who's really aggressive about doing things, grabbing the circuit board and such. You don't get to do anything at all; you just sit and take data. I think that happens a lot. One of my friends hooked up with another woman and they did a lot together. But the other girl just sort of sat there. My friend had to put it upon herself to play "the guy's role."

I think I've let that happen, too, sometimes. Just because it takes time to know what's going on: [you] flip a lot of switches and nothing works for a long time. So, if someone else is willing to do it, you sit back. Unfortunately, for the

last lab in EE 384 all the guys were doing it together and yelling out numbers, and I didn't know what was going on. I ended up working on my own, and it was really hard. It took me two hours—they did it in 20 minutes—but I felt a lot better about myself because I knew what was going on and had a better idea about the difficulties involved in this kind of circuit and equipment.

You feel that you're holding someone back [by asking questions] but it's really important for you to learn it, probably even more than the other person. It's tricky, though, because I can't guarantee that I won't let my lab partner do it all again. I'd like to think that I won't. I'm almost willing to work by myself; that'll ensure that I get stuff done.

I worked on problem sets with one person and it was really frustrating. He would be like "This is a resistor. You draw it like a zigzag . . ." and you knew all that stuff; you wanted him to skip to the stuff you didn't know.

I like the people I work with this year; I like my department a lot better because of them. One is just the greatest person to hack out a problem with because he listens to you—he gives you suggestions and vice versa. You go off and work on it; you get back together. It seems that he respects your opinions even if you have a really off-the-wall way you're trying to solve it. He'll ask you to explain it to him—"assume the chalk." If you have a theory on how to do it, you go up to the board and write it out. Everyone else would listen and try to understand—"Oh, you mean this, and this . . . yeah! yeah!" That was really nice.

Jenny Lee '92, Civil Engineering and Operations Research

The one thing that I really like about being Chinese-American is the close-knit family ties. I think that played a major role in my being able to get into here. My family was very supportive every step of the way. Even after I graduate they will be behind me 110.2223 percent. I tend to be overprotected, but I know they mean well because they love me. They're ready to let go. A lot of times I'll talk to them about a problem and they'll say, ok, you're old enough to deal with it by yourself.

While I value this aspect of being Chinese-American, there are some others that I wish would go away in a hurry. For instance the tradition to encourage your child to pursue some technical subject—biology, engineering, computer science. I wish that some Asian parents would understand that it's not so much what field we go into but what we're interested in and what we're happy with. So what if we're not making $60,000 a year and driving a Jaguar. Those are material things, and you can't really use those to replace the satisfaction you get from doing something that you enjoy.

I went through a series of transitions. First I started off thinking that I might want to go into biomedical engineering. BIO 203 changed my mind very quickly. I did not have a good experience with that class. So I switched to EE, but then after a semester of EE 283, I decided that I didn't want to spend the rest of my life in a lab so I chose a field that was more people-oriented. So now I'm here in operations research[OR].

If anything, this is the one field in engineering [offered here] that emphasizes the real-life applications, and it's really nice to have the professors point out, "Well, this is something that we actually use in industry." Last semester we did a project where we got to imitate a real company. We had to worry about production and distribution. It was a lot of fun working in a small group, trying to figure out how much to produce, whether or not to produce at all, figuring out how much to distribute to various retailers.

I had a big argument with my parents when I was changing my major because second semester sophomore year I was actually considering becoming an A.B. I wanted to go into languages, but my parents wouldn't hear of it. They gave me an hour-long lecture on my life and how practical it was to be an engineer—or at least something technical.

I said to them, "I talked with my director of studies and a whole bunch of professors, and they said that there were a lot of job opportunities for people with language backgrounds. For instance I could become a translator." They said, "Oh, no, no. You're going to starve in the streets"—of course, I'm completely over-simplifying the situation.

We finally came to a compromise: Lily, my Minority Affairs Adviser (MAA), suggested that I do something involving engineering management since that was somewhat people-oriented. With this major, I could combine engineering with a number of A.B. pursuits. I decided to try it out for a semester, even though I wasn't wild about probability and statistics. After a while, I decided that this was something that could actually get quite fun.

I'm definitely not going to grad school. Hopefully—fingers crossed—I'll be able to work for a company. I was thinking that I would like to do something really off the wall—nothing really technically related, but something that needs an operations research person—maybe a toy company—and help them optimize their production of kewpie dolls. Something like that would be interesting to apply OR to.

I don't think I could say that any one professor had one great significant impact on me, but my peers and my roommates influenced me. They were always very supportive, even when I felt most discouraged.

As important as my friends were, some didn't seem to have any confidence in my abilities as an engineering student. I remember them constantly telling me, maybe I should consider another field, maybe I should be an A.B. and not be an engineer. And I thought, "Gee, that's a real confidence booster." They could have said, "Well, it'll be okay, you'll get through it somehow." Instead, they encouraged me to switch majors. I guess [they didn't mean that as a] comment on my ability or lack thereof.

I still consider myself an engineer, which is probably good. Real engineers aren't neurotic about just one thing; they pursue other interests and are musicians or artists or something else. I'd like to think of myself as that kind of person.

For people currently in the program, don't get discouraged. I got discouraged, and I wanted to get out. Luckily I had the support of my family. Even

though I think, "Gee, I could have been some other major," I'm actually glad that I'm in Civ E; it's a great major. I remember telling a fellow engineer, "Isn't this a cool major? I can do anything with it!" Actually you can do anything with a lot of majors, but if you have an engineering degree, you can do A.B. type work—go into journalism or become an artist if you want to.

Seema Misra '92, History

I suppose because I left engineering, I think more of having been an "engineer" rather than being a "woman engineer." However, reflecting back on that time, I think I definitely experienced being a woman engineer.

I decided to study engineering because my father was an engineer. In fact, I chose chemical engineering because my father was a chemical engineer; I was always surprised at how many other women engineers had a parent who was an engineer. For women, it always seemed that they had a reason for studying engineering—"I'm good at math and science." For the male students, studying engineering was never even questioned. If they shrugged and said they were studying engineering because they did not know what else to study, this reason was readily accepted. I don't think a woman could have gotten away with that, and that's significant.

My first memory of being a woman in the engineering program was freshman week, when our director of studies gave everyone the "You are special. You were chosen to be in Princeton" speech at the residential college. Then, the engineers were asked to leave with their advisers to go to the E-Quad and the A.B.s stayed in Wilcox [at Wilson College]. I was walking with my group when I realized that there were (out of maybe twelve people) three women. I was talking with a group of guys and I had this urge to stop or slow down so I would be walking with the other two women.

But that was a fleeting memory. All through freshman year I saw plenty of women in Physics 103/104 and Chemistry 203. Of course I was one of two women in my math class (Math 203), but then I talked to nobody in that particular section. I never noticed anything because the two girls who lived across the hall from me were both engineers. We all took the same classes, and studied together. It was a horrible first semester academically. I really wasn't around too many male engineers in my one-and-a-half years—doing problem sets or doing labs—so I never experienced the different kind of interactions other [women] mentioned.

As a chemical engineer, even after the first year, I never noticed being a minority (except in differential equations). However, I do know that if someone was having trouble in engineering, it always seemed to be a woman. It seemed as though none of the guys had any problems. Now I realize that the women who said they were having trouble might be getting Cs, but a guy who received the same grade never considered himself as someone having trouble coping. In fact, very few of the women actually did get low grades. I think most of us on the

average did better (perhaps because there were fewer of us and we were more easily discouraged into dropping out unless we had good grades). I wish I had known that other people were doing as mediocre in some subjects as I was. I didn't have that confidence, and thus I was more willing to dismiss engineering.

Leaving engineering was something that had been on my mind since before I even came to Princeton. (I had applied as an English major.) My sophomore year I was doing much better (Bs and a couple As, not just Cs and a couple Bs). I was so happy; and because I was doing better, I considered staying in the engineering school—not because I wanted to be an engineer, though. I wanted to stay an engineer because I felt I owed it to other women. I felt that if I left engineering I would be labelled another "woman" (not person) who left engineering. Also, I felt [that] since I was able to be an engineer it was my duty to keep the percentage as high as possible. It's hard to explain this sense of responsibility I felt. Maybe it stemmed from all the "women have been invisible" stuff I had been reading. But in the end, I decided to do what was right for me and became a history major.

It's weird though. I never wanted to study the history of science, but I did want to study women in science. When I had to do a field study of any group, I chose women in the E-Quad. It's as though I feel a continual need to go back and understand what I lived through. And when I see engineering students who were in my classes I feel closer to them than I do to my A.B. friends.

Vickie Pisowicz '92, Mechanical and Aerospace Engineering

I didn't decide to go into engineering until probably late in my junior or senior year in high school. Until then, I wanted to be a marine biologist. I had done an internship at the Pittsburgh Zoo and conducted research on penguins. Later, I decided that that was not what I wanted to do.

I had a love for the sciences and I knew I wanted to go into something sciencey, so I looked at different options and decided that engineering had the best opportunities to do a wide variety of things. I wasn't sure which engineering I was going to pursue, probably either civil or mechanical. That I decided freshman year.

I think [I chose mechanical engineering because I liked] physics and mechanical things better than structural things. Dynamics is much more interesting to me. Next year, they're going to offer an aerospace structures course, and I think that'll be great.

I never really looked at Princeton at first. I play softball, and I had all intentions of going to Carnegie-Mellon. I was recruited heavily for softball [by several universities], and I never would have applied [to Princeton] if the coach didn't say, "Why haven't you applied?"

I really like it here: I like engineering and feel that I'm learning a lot. I'm not sure my grades show that, but I have learned so much already. When I go out and get a summer job—I've had an engineering job for the past two years—it's

amazing how much I know and can apply to things; it's a good feeling. I think I made the right decision in coming here.

I'm a first-generation college person—my parents didn't go to college. It's a different experience for me in general. A whole different world was opened to me as far as my lifestyle is concerned—not that it was any better or any worse. My parents want me to get good grades and everything, but when times were difficult, they were there for support. That's really important because our family is so close. Being apart is tension right there, but they were definitely supportive.

For me, being an engineer at Princeton requires a lot more work and a lot more time than for the people who sit next to me in class. I don't get the same grades that they do, but that really doesn't matter anymore as long as I understand the material and I learn something.

I want to do well, but comparing myself to other people isn't the main thing I get out of this experience as opposed to what I learn, what I know, and what I can take out to the world. There have been times that I've thought, "Why am I here, why am I doing this, why did I come to this school?"—I think everyone goes through it. But then we get through it and, once it's over, realize that we learned a lot and it was worth it.

Tina Neff '92, Biology

Flying and aviation have always been an important part of my life and when it was time to decide what I wanted to do after high school, it was a very important part of my decision. Although I had the ability, I did not have the eyesight necessary to become the commercial pilot I had always wanted to be. Because I wanted to do something involving aviation, I decided to combine my ability in math and science with my interest in flying by studying aerospace engineering. With this in mind, I had to find a school that had this program.

I decided to apply to Princeton as well as many other technical institutions because Princeton had one of the best aerospace programs in the country. When seeking advice regarding my application to Princeton, I was told that if I was lucky I might get into Princeton, but I would never get into the engineering program because West Virginia [where I was from] was notorious for having students with poor math and science backgrounds. Needless to say, I wanted to prove this person wrong, and I set my mind on getting into Princeton.

After my acceptance to Princeton, I wasn't sure I would come. This was because I was the first in my family to ever attend college and I believed the stereotype that Princeton students are snobs. After visiting many other colleges where I was treated as a number, I came for my visit to Princeton. I immediately fell in love. It was a beautiful campus full of beautiful, caring people. Students, recognizing that I was a prospective, would stop and ask if I had any questions, and the administration treated me as a person and not a number. In fact, my admissions officer even came to meet me.

During the visit I was introduced to the engineering school via a luncheon

sponsored by the Society of Women Engineers. It was so great to be in a room full of women who wanted to do something in a math/science field. It was a refreshing change to be among people who had the same interests as myself. I was a little nervous about my ability to succeed at Princeton, but everyone was really encouraging and I was reassured. That is, I was reassured until I met one student. Looking back, I realize that she was very bitter because she stayed in the engineering program even though she would have liked to do something else. I guess this is one of the shortcomings of the engineering program. You have to decide during your freshman year whether engineering is right for you, and if you change your mind during your sophomore year, it is generally too late. This particular student was a casualty of this system. At the time, however, I didn't realize her situation explained her remark that if I wasn't 100 percent sure, right at that moment, then I shouldn't be [an engineer]. This was not what I wanted to hear. I needed encouragement, not realism tainted with bitterness.

The situation worsened when I arrived at Princeton that fall. This student turned out to be my interactor. Needless to say, I wasn't very happy. Because I didn't want to be discouraged by her negative remarks I didn't seek her advice—advice that I really needed. I could have gone to my other interactor, but he was so busy with his independent work that he didn't really have much time. Besides, he had trouble relating to his female advisees. So basically I was on my own.

As the semester continued, I began to realize that it was going to be a tough battle. Although I had had all of the prerequisites the engineering school required, the basic engineering classes were taught on a level which required a semester more of math than the syllabus stated. Although I had a few friends who were engineers, I never felt like bothering them because I didn't want to take time away from their studies. Professors weren't much help. They didn't know how to relate to me, and most of them were inaccessible. The tutoring system and study halls were a great help, though.

It took me a while to catch up, but I finally did during my sophomore year. But it was at this time that I began considering that engineering might not be for me. I changed my major during the fall of sophomore year from engineering to biology. There were many factors influencing my decision. First, I realized that I would be miserable if I had to design planes that I would never be able to fly. Second, I wanted to do something that would allow me to go back to my home state. Third, I was very dissatisfied with the engineering curriculum. We basically did the same labs that had been done every year. The labs weren't an arena for learning. They were just another thing that we had to "get through" so we could start on real engineering.

One of the things that really made an impression on me during this time occurred when I went to my departmental adviser to get my degree change form signed. He didn't ask me why I was changing majors; he didn't encourage me to stay; he didn't do anything other than take the thirty seconds out of his busy schedule to sign the form and send me on my way. This was the unfeeling professor that you're warned about when applying to college.

It's not that all professors at Princeton are like this; in fact, it's just some of the professors I've encountered in the engineering school. It's too much of an antiseptic environment in which the professors are too caught up in their own research, and where people are afraid to help one another because it may lower their grade. I don't mean to sound completely negative because there were several great people who were encouraging and helpful, but they were not enough.

As a biology major I'm much happier. During my sophomore year I started doing neurochemical research with a psychology professor. I was actually doing something new—not research that had been done by hundreds of people before me. And I didn't have to wait while I took a lot of prerequisites to do "real" biology.

My engineering background was not a waste. I'm glad I went that route because the computer programming, higher math, physics, and chemistry are very important to what I want to do, and I probably wouldn't have taken them if I had gone directly into biology. The engineering program has a lot to offer, but some changes need to be made especially regarding women. The solution is not to treat women as "one of the boys" but to have sensitivity on the part of the professors as well as the administration that the women not only need equal treatment but also extra encouragement because there are still many women studying engineering who come from backgrounds in which they are told that women should not study math and science.

Kathy Prestridge '92, Mechanical and Aerospace Engineering

Sophomore year I felt pretty discouraged. I felt that I had the hardest major in the entire school. It had to be the worst because no one seemed to have the sheer volume of work at the same level of difficulty. It was so difficult and time-consuming, and I was depressed to see other people enjoying themselves while I was working on my problem sets and lab reports.

Though I was discouraged, it helped having Society of Women Engineers. I went to a couple of sessions on stress management and relaxation. I learned how to totally relax and how to have fun with friends and not think about work while I'm doing that. There was so much work that I let it overwhelm me.

But I never thought of leaving engineering. After freshman year, how could I leave? It would be too much like quitting. Anyway, with an engineering degree, I have the flexibility to go into law or a non-technical field later. Being at Princeton makes my options especially good since I have had the opportunity to take good courses in which I *have* to know how to write.

Lillian Yao '92, Computer Science

I don't really know [why I chose engineering]. I think being Chinese, there was more of a push towards the science and math areas. My parents probably pushed us more toward engineering because you can earn more money in that field—that old "We want you to be able to have more than we did" philosophy.

I went to a high school that had a special program in science and engineering, and from there I just figured that I might as well stick with it—another philosophy, "Once you pick a path, stick with it."

I am not bitter, though, only perhaps a little sad about reality. If I didn't have to worry about money and being able to give my future family a good, comfortable life, I might have been a classics major. After taking some classics classes here, I went through a short phase of wishing I had known earlier and had decided to be a classics major. But now, it is too late to change. Later on in life I may just go back to school and get a degree in classics. I don't regret being a CS major. I do enjoy programming and being able to create programs that actually bring to life the ideas in your head. I am also proud to be an engineer, for whatever respect that may gain.

My confidence was greatly shaken when I arrived here at Princeton. Even though most of the material in physics was covered in high school, I had never met so many smart kids before. Thus I concluded that I wasn't really smart at all, just a hard worker: I have to spend twice as much time studying for an exam and yet barely do as well. It was very frustrating. Fortunately, my math classes kept me from going insane. My confidence was slightly restored with them as well as with my classics classes. Computer classes also restored my confidence. It usually took me longer to figure out exactly what was required for programs, but once I did, I was fine. As much as I hate to say this, the one thing that probably affects confidence the most are grades. When you get a good grade, you feel great. When you don't, you feel dumb, stupid, and downright unworthy.

I generally enjoy the environment in the computer clusters. Fellow computer users/hackers/majors are there to bond with. That is where friendships are developed and nurtured. There is a special bond that is formed when the same few people spend night after night in the computer cluster working on project. Trips to Hoagie Haven with a bunch of friends are relaxing and very enjoyable. Heck, that is where I met my boyfriend and a lot of my good friends.

However, I do feel very, very uncomfortable when loud guys are there discussing the sexy, kinky, dirty [computer graphics pictures] that show naked women having sex or whatever with men. Why? I am slightly embarrassed, but mostly I think that it is so very rude. I also get really angry when I see users abusing the facilities, wasting paper or being loud and inconsiderate to other users. If this is the case in a certain computer cluster, then I will go out of my way to avoid using that cluster (which was the case the latter half of this year). This is quite unfortunate but attempting to battle the above problems (as I have tried) is fruitless—not because I am a woman, just because people don't listen and *are* inconsiderate.

Relationships with non-engineers are fine. Topics of discussion never include engineering-related stuff, but I do learn lots of other things from my A.B. friends so there is something to be gained there. I probably am better friends with my engineering friends (or A.B. CS majors, since they work just as hard [in the

computer clusters]) because of the loads of work we suffer together. Being an A.B. major seems so easy sometimes to an engineer, who all too often sees A.B. friends being able to party and play every weekend whereas an engineer may have time to do so only once in a blue moon.

After graduation, I hope to obtain a job with a computer firm which supports a program that helps employees obtain higher degrees. At that point, I would like to get a master's in CS. I have done some summer internship work—last summer at IBM and this summer at Hewlett Packard. From these experiences, I learn that there is a vast difference in what you know and what they know out there. It is not as hard to fit in, perhaps due to our good Princeton education, and what you do not know can be easily learned to a satisfactory degree (at least in the eyes of the company). Also, many things that you learn in school just are not used. The real world seems to focus more on specializing in a certain area.

Susan Ipri '93, Mechanical and Aerospace Engineering

I chose engineering because it was practical. I like to know why things happen and how things work. I had liked physics (people look at me funny when I say that, but I take it with a grain of salt), but it's too theoretical. Furthermore, my grandfather is a mechanical engineer and we were the same kind of people—the way we think, act, and think about problems.

I came to Princeton for several reasons. First, I didn't want a school that was purely technical (I have a sister at one—MIT). I wanted a school that was well known for liberal arts professors as well. A good quality program would make me work harder at my A.B. courses than if I had gone to a technical school.

I did well in high school so I was able to make the best of my college situation; I could go where I liked. I loved Princeton when I first showed up on campus—instinctively. It really hit me with a nice feeling.

I particularly love engineering at Princeton. I was able to get involved with E-Council, organizing dinners and such, and I've been able to become friends with Dean McCullough. I know a lot of the deans [through my activities] and the department secretary, and I feel that I have a stake in the engineering program and my own engineering education. Princeton tends to focus more on undergraduates. I can see potential problems being swallowed up [and ignored] in a large school that focuses on graduate students. Here, we're allowed to address the problems [that pertain to us as undergrads].

Freshman year was a lot of work. Many of my friends dropped out and grew to dislike [engineering]. I realized that though I enjoyed the courses, it was often the professor I didn't particularly like. Overall, I was excited about what I was learning, and never seriously wanted to be somewhere else besides Princeton.

However, I am not the most confident person. I get confidence from doing well. For example, differential equations was a real confidence roller-coaster; on the first exam, my confidence went down because I didn't do my best, but it

improved when I did well on the second. I've gained confidence in engineering by doing well in my engineering courses.

Sometimes my confidence goes down when I look around and see myself as a token person. I had a professor who had a habit of not calling on females. I got so worked up about that fact that I couldn't answer when I was asked. And I wasn't sure whether or not women were asked harder questions.

This didn't cause a sense of being put down, and I attributed it more to the individual professor. [The issue of women in engineering] is a problem in that it exists. It's much better than it could be in a lot of ways—there is acceptance, understanding, and no discrimination.

I don't think about the issue too much—I don't walk into a classroom and count the number of women. I don't automatically see that kind of situation, and I think that's part of the problem. I'm willing to talk about [being a woman in engineering] with people, but I am not a feminist.

I wish people could look at the problem with the attitude of "Let's start with the problem" rather than "This is what's there; how do we get around it?" I realize that it takes time to change, but I get leery of affirmative action—pushing just because a person's a woman or minority. That is questionable to me.

I've found that I've been forced by everyone else to evaluate my situation. It's made me more conscious of my reasons for being in engineering and made me more steadfast. My grandfather hoped someone would follow in his footsteps, but he didn't think it would be his granddaughter.

Jennifer Leslie '93, Mechanical and Aerospace Engineering

I wanted to be a physics major, had taken Physics 103/104, and near the end of spring semester, went to talk to my professor about it. When I told him I wanted to be a physics major, he kind of laughed and [suggested] that I look for another major—not in so many words, but that's what he implied. That's when I started thinking "maybe he's right" and looked toward engineering.

I liked physics basically because of Newtonian mechanics. I knew that wasn't what mechanical engineering was about, but I didn't like chemistry as much and I knew that I would not want to be an electrical engineer because I didn't like the electromagnetism part of my physics classes. I also like to see how practical things like cars work, and I like to design things: mechanical engineering seemed to provide the opportunity to [pursue both of these interests].

I thought the physics professor was kind of rude [in suggesting that I look at another major]; I didn't think it was fair. He probably did it because I was not acing the Physics 104 course and because there seems to be a feeling that people who are majors in physics should be in Physics 105/106 or 200-level courses their first year here. The physics department expects majors to come in with much more previous course work in physics, which seems contrary to the idea that physics is an option for every incoming student. At other universities, like state ones, our 103/104 levels would be advanced and what you would need to do in

order to be a physics major, or a real physicist. Of course, this is supposedly a better school than some state schools.

I just didn't think that it was fair that he was judging me on one class—I didn't even have him in Physics 103; based on one semester, he was judging that I would not be a good physicist. I have a feeling it was because of my gender, but there are a lot of possibilities.

Switching into the engineering program wasn't that bad, probably because it was only the end of my first year and I had already taken physics and some math. I think it would have been more difficult my sophomore year. I had a meeting with [the undergraduate dean], and he reviewed my courses. He talked to me about what I would have to do to "catch up" which turned out to be taking a computer science course over the summer and taking some courses [sophomore] year that other people took their first year.

They didn't mind my coming into the engineering program. Maybe they were happy to have someone entering, but I also sensed that maybe they knew I would drop out or something. I didn't get any bad vibes from [the undergraduate dean] and he didn't seem derogatory in any way, but there seems to be a whole atmosphere here in engineering that women aren't expected to last very long. So when you move into it, they don't worry about it because "she'll be gone next year"—but no one ever said that to me. Someone told me a story about a guy who flunked out of engineering a couple of times, and that's how I feel—especially since I'm a minority, too: they would expect me to drop out anyway.

I really think that I made the right choice. With all the classes and all the work, I was starting to feel very frustrated and was losing my confidence, but when it came time to do my thermo and fluids independent projects, which were more like real engineering, I enjoyed it a lot. That's when it hit me: I'm in the right major and I made the right choice. Maybe I have to go to these classes and maybe I won't ace them; maybe I'll feel frustrated, but I'll still work hard because in the end, I'm doing what I want.

I really like engineering: I like understanding the world around me technically. Engineering is giving me background on the world environmentally, and it's training me to think a certain way, which I feel is very important. If my huge grandiose ideas [for careers in the improvement of the aspects of my home state's educational system] don't work out, I can see myself working for a company for a while, too. I don't see industry as a [long-range] career, unless I really fall in love with it, because I feel more loyalty and dedication to making the world a little bit better.

Cathy Miller '93, Computer Science

In junior high school, I wanted to be a chemical engineer. I stayed with that idea until about junior or senior year when I met a woman in chemical engineering. She had come to the school and gave a talk on it. Then I changed my engineering plans abruptly when she only showed slides of her building and talked only of how much money she was making by building these factories. I

thought to myself, "No, I don't want to do that. I want to do something environmental," and I might have gone into civil engineering with the proper encouragement.

My brother was an electrical engineer and since I had been very interested in computers, I figured that if I went into electrical engineering and did computer engineering, I couldn't lose. That's how I chose my major. I eventually changed [to computer science] when I discovered that [electrical engineering] was mainly signals. I found that I had the most fun programming and not doing the actual hardware work.

I'm going to be a programmer [after I graduate]. I'm not going to graduate school. At this point, there's very little directing me toward grad school, and I think it's the same for most computer science majors, male or female. There are a lot of jobs out there for computer science people. Unless I want to teach, there doesn't seem to be any point in pursuing a Ph.D. at this time.

Donna Riley '93, Chemical Engineering

I wanted to be a chemical engineer in high school because I was good in math and science; my school was all girls, so there was no stigma attached to pursuing engineering. I really felt when I came to Princeton that I had slammed into a brick wall in this respect. Princeton is bound to challenge anyone's intellectual ego, but a woman in engineering wonders whether she just can't do math and science because she's a woman. I have contemplated changing majors, and I still do. I have had the distant goal of becoming an environmentalist and saving the earth by methods of chemical engineering, but it would be wonderful to major in religion and be an academic, living at a university for the rest of my life. The two life plans are so different, and at the same time they are equally far off, and even unattainable when I look at this society and the roles which I must play to be accepted by it.

Sometimes people tell me how lucky I am to have grown up in the '80s so I can major in engineering, and that I should major in it because we need more women in the field and I should show men I can do it. In a way, I'm really just trying to show myself that I can do it. I often wonder if I'm staying in engineering for these reasons, or if I really intend to use this for a career in the environment. I do intend to go to graduate school whatever I choose to major in, with the realization that it's going to be even harder for me there as a woman. I suppose just being here or just going to grad school in itself is a great accomplishment for a woman, but gender shouldn't be viewed as a handicap in this way.

Sometimes I feel like I can expect from myself everything a man can expect from himself, and society's expectations are inconsequential, but I cannot always believe this. There's a point where society interferes with my intellectual ability, but I too often blame myself for this shortcoming, and to accept myself within this shortcoming is to accept this shortcoming for *all* women, so I must continually fight it, despite the cost.

Melissa Tamada '93, Electrical Engineering

I wanted to go to an English speaking school since I went to International School [for high school]. I really liked Wellesley and Princeton. I did apply to Wellesley but did not go because it wasn't co-ed. I guess I like being with guys both in class and outside.

I originally was an A.B.; I didn't know that Princeton had engineering when I first applied. I was thinking of math but randomly found myself at an electrical engineering orientation meeting. I was thinking of pre-med and [have continued with this program]. Why I chose EE over, say, mechanical was because I liked math more than physics and the relation of EE seemed stronger to math.

Now I'm happy in EE although EE 283 made me skeptical of being in engineering. At first, I found it bizarre being in the E-Quad, and then I thought I wasn't good enough in class. There'd always be a guy in front of me who was already answering professors' questions while I was still trying to write them down. I was very impressed by these people. But I found that it was [a] different situation on the exams. EE 284 convinced me to stay in. As a female, I believe that I lack the tinkering experience that the guys have. I'm more into theory and courses, and I'm okay now. Next year I'll be working on independent work, so I'll get to see the applications, no longer doing things in the air. My confidence is building now.

I'm pre-med, too, and I've found my classmates there to be very competitive and, well, mean. When I'd ask them how to do something, they'd say, "I think it was said in lecture on Thursday, blah, blah, blah" but I already knew that. They just didn't want to help me.

While doing my engineering problem sets, I learned to ask for help. We all get together in the library and work. It's one of the reasons I decided to stay in engineering; there's more teamwork and [it seems more] constructive. I'm sure [these skills] can be extended to [the world] outside Princeton as well.

I am not very competitive grade-wise. This does not mean that I don't like As—when they give it to me, I don't complain. In EE 283 I worked really hard and got a B. It seems a bizarre way of grading. My Society of Women Engineers big sister told me that she worked really hard at the same course and got a C. That helped me a lot, because then I concentrated on learning and didn't worry so much about the grade.

At first I found the atmosphere intimidating, but I have a few EE friends [now]. I had a birthday recently, and my friends called me over to the CS building for "a problem session." Instead, they pulled out a cake and had a surprise party for me. It was really nice.

If you have built castles in the air, your work need not be lost; that is where they should be. Now put foundations under them.

— Henry David Thoreau

The Princeton Experience: Engineering and More

There are many truths of which the full meaning cannot be realized until personal experience has brought it home.

—John Stuart Mill

ALTHOUGH THIS IS NOT EXACTLY A SOUND STATISTICAL SAMPLING, HEREIN LIES MORE WOMEN ENGINEERS' STORIES THAN MANY OF US WOULD EVER ENCOUNTER IN COLLEGE, MAYBE EVEN IN OUR ENTIRE CAREERS. THIS IS THE MEAT OF THIS BOOK, THE MAIN PURPOSE. WHAT HAVE WE LEARNED, ACADEMICALLY AND SOCIALLY, IN OUR COLLEGE YEARS AND HOW HAS THAT AFFECTED OUR VIEW OF OUR LIVES AND THE WORLD?

The Published Record ...

"College Admits Women to New Defense Course," *Daily Princetonian*, May 30, 1942

One of the few remaining strongholds of the male, the classrooms of Princeton University, have been opened by the war to women students for the first time in the 196 years of its existence. The Princeton School of Engineering will offer a tuition-free, college-grade course in photogrammetry to both men and women during the nine-week summer session from June 29 to August 29, Kenneth H. Condit '13, Dean of the School of Engineering, announced yesterday.

All phases of map-making—surveying, interpretation of aerial photographs, the plotting of land surfaces, and the use of various map-making instruments—are included in this course. Classes will be held in the evening as well as the daytime meeting for three 3-hour periods a week.

The purpose of this emergency instruction is to fill the specific need of the Federal government for skilled map-makers. According to the U.S. Civil Service Commission, all grades of engineering aid (topographic and photogrammetric) from $1,440 to $2,600 are needed urgently, and those who complete the special training in the course will be qualified for immediate employment in the National Defense Mapping Program. The women graduates, as well as the men,

will be welcomed for such employment because, as the Civil Service Commission states, "there is an increasing demand for female personnel in all sub-professional engineering aid positions."

The instruction will be on a college level and will be open only to applicants who have completed three and one half years of college training, or two years of college training including some courses in science, or the equivalent in experience. It is also necessary that the applicants have binocular vision.

The Engineering School is able to give this course free of charge because it is being supported by the funds of the U.S. Office of Education as part of its program to train men and women for national defense positions.

Captions from "Princeton Goes Coed," *Sunday News*, July 12, 1942

• Camera doesn't lie. Here is irrefutable proof of the rumor that Princeton University (so help us!) now has gal students. Yep, 23 of the fairer sex are enrolled in the school's new map course . . .

• Studious. Dorothy Brown, who attended M.I.T. before she aided in ruining Princeton's bachelor status, matches aerial views for map class.

From The Patterson Report on Coeducation, *Princeton Alumni Weekly*, September 24, 1968, p. 22–23, "Lessons from M.I.T."

Our mandate was to study the question of Princeton's entering "significantly" into the education of women, which we interpreted to mean at least the minimum number of women necessary to achieve for both men and women students a large share of the educational benefits to be derived from a mixed student body. However, we have also considered the possibility of bringing women to Princeton in very small numbers—say 2 to 3 percent of the student body in the early years—to be followed by a very gradual growth, *but* with neither the rate of growth nor the final objective being a part of the initial policy decision. This is an approach followed for nearly a century at M.I.T. Everyone with whom we talked at that institution believed that the present 95–5 male to female ratio was a great improvement over the 97–3 ratio which had prevailed until very recently, and there was virtually unanimous agreement that an increase, say to a ratio of 90–10, would be de-sirable. Nevertheless, M.I.T. has found satisfactory a much lower ratio than we recommend for Princeton.

In the view of those at M.I.T., however, it would be dangerous indeed to generalize from their relative success with such a small ratio of women. This is so for several reasons: (1) Many of the girls who come to M.I.T. have an almost religious fervor about the importance of science; in applying for admission to M.I.T., many have already gone against the advice of friends, guidance counselors, and often parents. They regard M.I.T. as the center of the scientific world. For all these reasons, they are quite prepared to overlook any disadvantages that might flow from their small numbers. (2) Because of the nature of M.I.T., the girls there quite easily "connect" with a small community—in a laboratory

group, as members of a professor's "team," etc. The result of this is that, for an important part of the academic work, the significant male-female ratio is not 95–5 but more in the neighborhood of 80–20. (3) M.I.T. is in the center of a metropolitan area, so that, for all but strictly academic work, the girls are not forced by their small numbers to adjust to that essentially all-male environment. In other words, they do not have to "fit in" to what they themselves accept as a male institution to the same extent that they would have to in a community such as Princeton if their numbers here were so small.

Still, something can be said for Princeton's admitting women in very small numbers. While the additional cost per female would be very much higher, the total additional cost would be smaller than for 1,000 women. Moreover, such an approach is appealing to some who favor coeducation at Princeton because it might permit the University to break its all-male tradition while at the same time avoiding the risk of creating as much opposition as a bolder program could provoke. Some find it attractive because it would accomplish at relatively small cost the important objective of removing any stigma that may come to be attached to Princeton in the future resulting from its discriminatory admissions practice. Perhaps most important is that it would permit experimentation before certain of the larger capital commitments—especially housing—were made.

But, in our view, these benefits are not nearly enough to recommend the policy. Few of the advantages of coeducation discussed in the preceding chapter would accrue if the number were so small. A female component of 3 to 4 percent would have virtually no effect on classroom activities, on extracurricular and social life, on the number and kinds of men who apply, on faculty recruitment, on the structure of the curriculum, etc. A much more serious shortcoming of this policy would be the shortchanging of women for a long time, if for no other reason than that the University would find, as M.I.T. did for so long, that it could not afford to improve the facilities and opportunities for women because to do so would be to make financial investments disproportionate to the percentage of the student group represented. Moreover, the minimal approach, according to a Princeton alumnus who is now Director of Psychological Services at a coeducational college, would "...be a doomed experiment in frustration, and one which would seriously hamper the contribution of the women students because of their extreme minority position." Very small numbers would probably also discourage all but the most confident, strong-willed and determined women (as seems often to have been the case at M.I.T.) and, further, would probably result in an abnormally high drop-out or transfer rate. With such a minimal policy, the University could not, in good conscience, encourage secondary schools to send their most gifted girls as well as boys to Princeton.

Whereas small numbers might permit Princeton to reply "not guilty" to the charge of discrimination on the basis of sex, the University would still have to answer to the charge that integration was token only, and that Princeton had settled for mini-solutions, showing an unbecoming lack of courage, confidence

and verve. The only answer to these charges might be that financial considerations ruled out any other immediate solution, but that the University was firmly committed to a policy of admitting a substantial number of women when the resources could be found.

In our view, which is shared by a large majority of the faculty and those Princeton alumni professionally engaged in education, should the decision be to admit women, the decision should be unequivocal: It should aim at an undergraduate student body consisting of not less than 25 percent women; it should provide for the immediate implementation of the initial phases; it should reflect the hope that the transition period would be as short as possible.

From "An Account of the School of Engineering and Applied Science of Princeton University 1954–1971"

Joseph Elgin, former Dean of Engineering: In 1969–1970 Princeton embarked on a program of coeducation with an initial group of 170 women. Although the [Engineering] School's administration and many of its faculty were interested in attracting women students to engineering, the University's entrance into coeducation did not immediately result in a significant number of women applicants for engineering. It has been the feeling of the writer and many others that women constitute a promising group of potential engineers. With a continuous effort to attract women to engineering, by the 1973–1974 session, the number of women undergraduates enrolled in Engineering was to grow from a handful initially to 38, about 7 percent of the total engineering enrollment.

From "Dramatizing Engineering," *Bric-a-Brac*, 1974, p. 24

. . . My class was distinguished by being the first engineering class to boast more than three female members. At a reception during freshman week, the dean of the engineering school proudly announced that our entering class included nearly fifty football captains, an approximately equal number of class presidents, and fourteen women engineers. Somehow, I felt this grouping to be a dubious honor and was slightly disturbed at being singled out as an interesting statistic. In addition, since we women were the only visibly distinct group, our group status was doubly emphasized. For several months thereafter we were known as "the Fourteen."

A group spirit did exist among us by the second semester—created, perhaps, by virtue of our group label and by the fact that we had many classes together. (Freshman engineers take primarily the same courses.) Personally, I felt the need to be with other female engineers and to develop an identity as such. For whatever vague and various reasons, we banded together to form a student chapter of the Society of Women Engineers (SWE) in February of 1973.

Sophomore year brought about several significant changes. The character of the group changed as a few women decided engineering was not for them and as several new women transferred into engineering. The group's spirit seemed to

dissipate as we scattered ourselves among the four departments. Our group association now focuses itself primarily within our separate departments. Due to the isolating influence of our departmental courses, we each generally see only the women in our department.

I am most struck by the apparent dramatic reversal in attitude toward SWE. Support and interest in the chapter by the women in my class has virtually died out. Perhaps it is because we are scattered among the departments and because we no longer have the time to get involved. Or perhaps we've already outgrown the need for such a group. For example, I personally am now secure in my identity as an engineering student. I find my sex irrelevant to engineering and sense no special consideration or treatment because I am female. Male classmates accept me as an engineering student like themselves. . . .

From "Engineering: in the U.S. and at Princeton," *University: A Princeton Quarterly*, Spring 1976, p. 18

"More men have dropped out than have women, proportionately, and women seem to work harder than men. They have more anxiety and put in more time. The reasons for it," [Assistant Dean of Engineering Bob Schaefer] surmised, "might be that the decision among women to be engineers is more carefully thought-out than it is among men. Also, I think women are not as easily discouraged. If you are a woman, you know you have to make your mark in a field not overly populated by women. There's an open invitation to come and try."

Prof. Enoch Durbin, of aerospace engineering, said of his women students: "They're sharper than men. They have to be. They're putting their heads in the lion's mouth."

From "President's Report on Coeducation," April 1980, p. 11

One useful way of obtaining an overall impression is by examining the relative numbers of women concentrating in each of the major divisions of the University in 1974–75 (the earliest year for which the data on women majors are very meaningful) and in 1979–80. The one clearly significant change that has occurred has been in the relative number of women majoring in Engineering and Applied Science. The number increased more than seven fold (from 10 to 76) over a period in which the total number of women concentrators in all departments increased by 31 percent. Whereas only 2 percent of all women concentrated in engineering in 1974–75, 10 percent of women students are now in engineering, including one of the two students who this year shared the Pyne Prize. . . Except for this one dramatic trend, the broad pattern of majors elected by women has been remarkably stable these last six years.

***The Montreal Massacre as reported from* The Daily Princetonian**

From "World News. . . from the Associated Press," December 7, 1989, p. 2

A man in a hunter's outfit walked through the University of Montreal engineering school yesterday firing a rifle "at anything that moved," killing 11 people and wounding many others before shooting himself to death, police said.

Witnesses said the young man roamed the halls, a computer room, the cafeteria and a classroom shooting students indiscriminately.

Montreal police spokesman Serge St. Laurent, reporting on casualties, said several of the wounded were in serious condition.

From "World News. . . from the Associated Press," December 8, 1989, p. 2

The gunman who raged through the University of Montreal's engineering school and killed 14 women carried a suicide letter complaining that women had spoiled his life and he was seeking revenge, police said yesterday.

In his rampage Wednesday afternoon, the young killer—identified yesterday night as Marc Lapin—also wounded nine women and four men before killing himself yesterday in the worst mass murder in Canadian history.

As he roamed through the modern six-story engineering building, firing a rifle, he shouted at one point, "You're all a bunch of feminists."

One of the wounded remained in critical but stable condition yesterday. The rest were out of danger.

"He mentioned in the letter that he did that because of political reasons. He said feminists kind of spoiled his life and he hasn't been happy in life for the last seven years," senior police investigator Jacques Dushcheneau said.

From "Students Commemorate Deaths of Women Engineers in Montreal," December 12, 1989, p. 1

"The men were sent out of the room, the women were killed," repeated Katrina Browne '90 three times at the opening of last night's candlelight vigil recognizing the victims of Wednesday's slaying of 14 women at the University of Montreal.

Approximately 100 people—about one-quarter of whom were male—gathered in Firestone Plaza to express anger, fear and sorrow over the largest mass murder in Canadian history.

Shouting "You're all feminists! I hate feminists!" a gunman killed most of the women in a classroom in the university's engineering school, then shot at other female students in other parts of the building before turning his semi-automatic rifle on himself. A lengthy suicide note found on his body reportedly blamed women for his life's failures and disappointments.

Calling the act one of "indiscriminate discrimination," Browne denounced the labeling of the incident as an isolated event. She said it was a "highly understandable" act and symptomatic of society's negative attitude towards women.

The purpose of the vigil was to enable students to "express their solidarity with the women who were murdered and who continue to struggle in our society," said Women's Center Director Janis Strout.

At the beginning of the 85-minute ceremony, Browne asked for a moment of silence for the dead. The participants—who outnumbered the candles provided—bowed their heads to pay respect for the victims.

Browne noted that one woman in the classroom claimed, "But I'm not a feminist." She was fired at as well.

"We are really taught to despise women in this society," said vigil-organizer Jessica Hall '92, who linked the Canadian massacre with Princeton students who defaced Women's Center flyers announcing the vigil and other events. One defacer changed the word "vigil" to "virgin," Hall said.

Hall then invited participants to come up to the microphone and speak if they felt moved. The first volunteer, who identified herself as a female engineer, said in a shaky voice that we must "live to be what they could have been."

One man who approached the mike said he was "personally insulted" by other speakers' statements that anti-female "prejudice is unanimous." He said that such generalizations would only "antagonize and exclude men from the cause" of equal rights.

Another man, a Princeton graduate student from Montreal, said he has a female friend who came within "five minutes" of possibly being involved with the murders. "The ball is in our court," he said, urging males to get involved with the equal rights movement.

The Women's Center has not had an official meeting since the mass-murder, Browne said, but she and Hall took the initiative to organize the vigil. Other sponsors included the Office of the President, the School of Engineering and Applied Sciences, the Society of Black Engineers, Men Against Violence Against Women, and SHARE, the University sexual harassment office.

Partly because of the short timespan during which the vigil was organized, there were no guest speakers for the event. The free-form ceremony was chosen so that "people would be encouraged to say what they feel," Strout said.

Some Pictures of Phoenix

[Editor's Note: "Phoenix" is a computer system available to members of the University, and many engineering students have accounts on it. This computer network, through which users access information, constitutes its own community complete with an easy means of communication. While this modern medium has many benefits, it has also presented a new vehicle for harassment.]

Read off the phoenix msgs, April 13, 1991

A user at another site (outside Princeton) requested a "talk" with me earlier this evening. I did not write down the entire userid before I forgot it. Unfortunately, since the user proved to be interested in the electronic equivalent of heavy

breathing on the telephone, and when I told him (I assume the user was a he) that I thought him rude, he told me that I couldn't find him (only partly true) and added "pretentious bitch" before breaking the connection.

I'd like to track the jerk down, so if <partial userid> tries to contact you, please write the full node name down post haste and send e-mail to me or the phoenix administrator.

Any harassment, sexual or otherwise, is not an appropriate use of the network. If this person attempts to get his jollies by having a kinky talk session with you, I hope you will instead help me track him down so that I can ask his system administrator to yank his userid. Thank you for all your support.

An Administrator's Experience: Kennedy Lemke, Phoenix Computer System Administrator

The one thing that jumps out at me right away is the fact that there seems to be a much larger percentage of phoenix users who are male than female. For example, if on phoenix you type "finger,"* you'll note that most of the time, less than 10 percent of the users are female.

I think that some male users both here at Princeton and at other sites use the "finger" command to find out who the females are that are currently using the computer. Then they will sometimes send them mail or use "talk." This is probably analogous to someone going through the phone book looking for women's names and then calling them on the phone.

On UNIX, any user can prevent someone attempting to use "talk" or "write" to them just by typing "mesg n". We had an incident where someone on a computer in Indiana was sending out messages via [another] command to phoenix users saying that he was a lonely student and wanted to talk to someone. [The command he used] sends messages to everyone regardless of whether they have mesg set to "n" or "y." At the request of a couple of users, I disabled the [command] so that this can't be done on phoenix anymore.

... Personal Voices

Patricia Kuntz Falcone '74, Aerospace and Mechanical Sciences (now Mechanical and Aerospace Engineering)

First the preliminaries, I graduated in 1974 with a B.S.E. from the then-AMS (Aerospace and Mechanical Sciences) Department. My small claim to fame (everyone had one in our days) was that I was the first woman to receive a B.S.E. who had spent four years in the program.

Some newspaper articles about our graduation highlighted this fact. (A '73 woman, Kit Meyers, transferred in from math during her junior or senior year

* *"Finger" is a command that provides a list of people currently using the computer system. It can be used by people at other locations (for example, other universities) to see who is logged on to phoenix.*

and is thus the first official degree recipient.) I received an M.S. and Ph.D. in mechanical engineering from Stanford in 1975 and 1981, respectively. My dissertation dealt with the application of an advanced laser diagnostic technique to measurements of pollutants in combustion systems.

I have been married for the past 14 years to Roger Falcone, also '74 (A.B. Physics) and we have a seven-year-old daughter and a one-year-old son. Roger and I met in an engineering class our sophomore year. It's nice to have the shared Princeton background (and Stanford too, for that matter) because alumni activities are equally appealing.

Gender and being a "pioneer" were a hallmark of my years at Princeton. They prepared me well for the years to come and, frankly, after Princeton, everything else has been relatively straightforward in comparison.

I became an engineer originally because I was "good at math and science and liked to solve problems." Those words were always a litany, and after saying them, I still didn't know what engineering was. I stuck with engineering because it was interesting; it wasn't obvious what I would switch to; and job prospects were promising.

There were few women in my physics, chemistry, and math classes and none in my engineering classes. I saw occasional women in my elective English classes and found joining an eating club was the first time I was around a substantial number of women. At that time everyone was busy with specialized activities. I felt the most kinship with many women in Tower Club, and eating there balanced the engineering classes.

Like many other early co-eds have mentioned, I was often asked for the "women's point of view" in precepts and often apologized to in engineering classes when a derivation went wrong and the professor said something "not meant for feminine ears." A very memorable experience was walking into the Freshman Week engineering meeting and having the room rise and shout, "a girl, a girl, a girl." The experiences were both aggravating and challenging. I keep thinking of war stories we could all commiserate with—like taking physics in Palmer Hall. There were no ladies rooms [there] so when I was ill during a final, I had to waste valuable exam time hunting the appropriate facilities in the music building. Then there was the pride we felt about being "co-eds" when those off-campus, frivolous (or so we assumed—incorrectly, I guess) weekend dates showed up in Commons.

On the other hand, I had no overt experiences of sexual harassment. I started in chemical engineering and had an adviser who noted that I should recognize that the professors worked for me and that it would be a waste of time to get a part-time job when I could use the time to study. It was heady advice for someone who thought she might not belong at as exalted a place as Princeton. It was an initial, but common, experience with dedicated faculty and outstanding teaching.

I transferred to AMS freshman year under the guidance of Professor Irv Glassman. I was concerned about the rigidity of the chemical engineering

curriculum, and a senior suggested I call Professor Glassman. I never thought a senior professor would take time to counsel a freshman, but he was wonderful. I was interested in environmental- and energy-related studies and impressed by Professor Glassman's combustion research. He suggested I put together courses I thought made sense and then we'd talk about it. His attitude gave me a feeling of flexibility, and the curriculum we devised turned out to be fairly traditional, with a strong complement of English courses for diversion.

In laboratory courses, technicians assumed I knew nothing and helped me learn, while the men were assumed to know more about the equipment than many actually did. I appreciate the many fine faculty in the AMS department—Irv Glassman, Seymour Bogdonoff, Jerry Smith, Francis Hama, Pat Curtiss, Bob Jahn, Rob Socolow, Barrie Royce. I received a good education at Princeton. I was well-prepared for graduate work at Stanford, and for my work at Sandia.

Claire M. Shortall '76, Chemical Engineering

Supposedly, 14 of us started as freshman in the fall of 1972. I think I remember each of the other 13 even though many dropped out of engineering before our sophomore year. We started our first year as a statistic. To the administration, we seemed to be a welcomed surprise. At the time, there were only three other women undergraduates enrolled in engineering at Princeton; their names will forever be embedded in my memory.

While I knew engineering was a bit unusual for women, I don't think I realized how unusual it really was until I started college. In many ways, there was a distinct commitment made by the engineering administration to be sure we weren't alienated. In particular, Joyce Dean, an assistant in the engineering school's dean's office, encouraged us to get together in order to take study breaks, keep in contact, and discuss concerns. She was always available to talk with us and provide moral support.

There may have been more pressure for us to succeed and more obstacles for us to overcome, but we also had our own network, small as it was, from the beginning. She arranged for us to meet with working women engineers and encouraged us to form a SWE student section. By the end of our freshman year, Princeton became the 42nd student section chartered by SWE. (There are now about 240 student sections in the United States and Puerto Rico.)

So many events occurred between freshman year and graduation. I recall only half of the original group, plus one who transferred from A.B., graduated with B.S.E.s in June 1976. The three of us who majored in chemical engineering were crazy enough to have roomed together during sophomore year. I've often wondered if we survived as B.S.E.s because we were roommates... or if we sensed we would be survivors and therefore roomed together.

The other (three, I believe) women who started in the department our sophomore year all transferred to A.B. While I certainly had my doubts about what I had gotten myself into, I didn't know what else to do! As a result, I

plodded along in the department. I knew I could reasonably do the work. More importantly, I received plenty of encouragement from fellow students and the engineering faculty, and I knew the degree would enable me to get a job that could be used as a stepping stone for other opportunities (and pay off my student loans).

While there was a common bond between the women engineering students, we individually participated in many different activities. I found myself at the boathouse in response to Amy Richlin's quote on the women's crew flyer: "The way I see it, if you liked to do things the easy way, you wouldn't be at Princeton."

For more than a year, my daily routine included practice with the team. The week after the Head of the Charles in the fall of 1973 found me checked into the infirmary with low-grade mononucleosis. After that, crew fell by the wayside. As I rowed, other women engineering students were on the gymnastics, ice hockey, fencing, and other teams.

Like many undergraduates, working was part of my financial aid package. I had fun with the Refreshment Agency and later at Commons. When the dean of the engineering school was asked to recommend two women undergraduates on financial aid to work part-time at Mobil Research & Development, I was fortunate to be considered. (The pay was much better, and the experience was a plus.)

There were so many things to do. It seemed as though one of my roommates and I attended almost every home football, basketball, and ice hockey game. Like a lot of the Chem Es, we joined Dial Lodge our sophomore year. (Tiger Inn drew a considerable number of Chem Es as well, but that was not an option for the women in my class!) Chem Es were known to work hard and play hard.

The legal drinking age was reduced to 18 four months after we started our freshman year. (Although I recall there was plenty of beer on campus prior to January 1, 1973!) We studied, we pulled many all-nighters, but we also had fun and partied. Somehow I also found time to attend meetings for Engineering Council, American Institute of Chemical Engineers, and, of course, SWE.

As different as being a woman engineering student may have been, I still feel that overall I was accepted as "one of the guys" while at Princeton. My lab partners were often men. I studied with them more often that I studied with my roommates. (If sophomore year was interesting with three Chem Es and a Russian major, junior year was a riot with four Chem Es (two juniors and two sophomores) rooming together!)

One day early my sophomore year, I arrived at Lower Cloister to eat lunch early. I was one of the first to enter. I sat at a table near the side of the room about halfway into the dining hall with one of my lab partners. I was in a hurry that day and wasn't paying much attention to my surroundings.

All of a sudden, I realized almost half the room had filled up and there wasn't another woman in sight. I thought I was mistaken. I turned to the guy I was eating with and asked him to look around and tell me if he noticed anything unusual. Of course he didn't. That was one of the few times in my life

that I can honestly say I felt alone in a crowded room.

There weren't many women in our classes, but there were a number of A.B. women in freshman chemistry and physics and organic chemistry. In those large lecture halls, the ratios didn't seem all that terrible. But math classes were another story. Only once did I find myself to be the only woman in a class. That was Math 201 (linear algebra), which I took second semester freshman year. It was also the only class I took where the professor obviously disapproved of a woman being there. Maybe he wouldn't have acted the same [way] if there had been other women in the class. How many times I heard him ask if I understood what was being discussed. I can still remember the day one of the guys said, "She certainly does, but I don't!" Many of the guys would tell me they didn't know how I put up with him. What choice did I have? I didn't say anything about his attitude, except to my supportive classmates (and probably to fellow SWE members). I also didn't protest my grade, but I'm convinced he lowered it from an A- to a B+ just because he felt I didn't belong in his class. (I've never told that to anyone before now.)

Now that I've rambled, one would think that the Princeton engineering experience prepared me for the business world. If ratios seemed bad at Princeton, they didn't compare to the workforce. Women engineers graduating in 1976 were few and far between. In many respects, that year marked the start of a dramatic increase in the number of women graduating with engineering degrees, both at Princeton and throughout the United States. According to statistics released by AAES (American Association of Engineering Societies), 1,376 women received bachelor's degrees in engineering in 1976, a 57 percent increase over 1975. We represented only 3.6 percent of those granted bachelor's degrees in engineering in 1976. (Source: *AAES Engineering Manpower Bulletin*, Number 99, December 1989.) Face it, there weren't many women engineers already in the workforce when I graduated. In retrospect, Princeton was a sheltered environment for me. After all, there were high-achieving women pursuing a variety of degrees. Being a woman at Princeton wasn't that unique in 1976. I can't say the same about being a professional woman in the corporate arena.

While I clearly remember being the only woman in my Math 201 section and that day in Lower Cloister, I quickly lost count of the number of times I was the only woman in a business meeting. I still find I'm the only woman, or one of only a few women, at business meetings. (I also still find myself having lunch meetings at essentially all-male clubs.) While I've moved from engineering into finance-related areas, there still aren't that many professional women in the industries (chemicals, oil, and utilities) for which I've worked. There are more women now, but few at similar or higher levels.

I sometimes wonder how much of my memory is clouded with respect to Princeton in general and the engineering school in particular. It was tough being an engineering student, but I managed . . . I had fun, too. I do believe, however, that Princeton was a sheltered environment compared to the business world.

Nevertheless, I'm also managing in it—and having a good time despite the frustrations.

Molly Follette Story '78, Civil Engineering

I did very well in math in high school, so my big brother (who had gone to MIT as an electrical engineer) suggested that I consider engineering as a college major. I didn't know what else to do, and it seemed *daring* (an important quality when one is 18), so I decided to try it. I had no idea what engineering was.

I had completed all the math my high school offered, which did not include calculus, by the end of my junior year, so I conducted various math-related special projects during my senior year. The nearest calculus course was a long way from my home, and I had no easy way to get there. I did not know how far behind it would put me not to take it.

At Princeton, I received an unexpected shock. Everyone there seemed to have had at least pre-calculus in high school, if not a full-blown course in it. Consequently, the professors (mostly foreign-born and hard to understand while lecturing) skipped right over the basics and taught the tougher parts of the subject. I was behind when I arrived on campus, and I never caught up. In high school, I received math awards for being the best student in the school; my math grades at Princeton were all Cs and below. I still regret them. They seriously affected my self-confidence, particularly my sense of self-worth in relation to my classmates.

The highlight academic experience of my freshman year at Princeton was a course titled, "Structures and the Urban Environment," taught by Professor David Billington. The lectures were held in a nice, cushy auditorium right after lunch, and Professor Billington showed slides. A lot of people fell asleep, but I was one of only a few people taking notes. Not only did I take notes, but I also *sketched* most of the structures of which he showed pictures: wonderful Maillart bridges, Eames buildings, various towers from around the world. The course made me want to become a structural engineer, which is what I did end up majoring in and practicing for two years after graduation.

My professors were very helpful to me and my fellow female classmates, often going farther out of their way for us than for our male counterparts, it seemed. Not all of them, particularly the older professors, were altogether comfortable with having women students (who would go on to become *professionals*), but they tried hard to adapt. Some of the graduate student teaching assistants, on the other hand, were less gracious.

In my sophomore year, I took a basic structural design course from Dr. Arnold Kerr. I had some trouble with it and got a low grade on the midterm exam. Concerned, I went to talk to the TA in charge of my problem section. He asked me what my major was. I was surprised, and told him civil engineering. He just laughed, and told me I could always get married. . .

Upset, I left and went to see Professor Kerr. He was concerned about the

comment and very impressed with the notes I took during his lectures. (He even borrowed them a couple of times to show to other people.) He told me I could come meet with him once a week instead of going to the problem session. I learned a lot that quarter and ended up working for Dr. Kerr on campus that summer.

Anonymous '79, Chemical Engineering

At the time I was choosing colleges, I had already decided to consider engineering, based on some discussions with my high school physics teacher. I still ranked it as my third choice behind biochemistry and English. Engineering options made me choose Princeton over other Ivy schools. Back in the mid-'70s, schools took an affirmative role in letting potential women engineering majors know about the engineering program. This helped keep engineering in mind as I chose my freshman courses. I didn't finalize my decision until the spring deadline freshman year. So I guess being a woman increased the amount I knew about engineering at Princeton before I declared the major.

When I first wandered over to the E-Quad during some open-house type event they had, I was fascinated by the amount of drawing (an avocation) going on. There was laughter in the halls and a sense of optimism/practicality that I missed in physics class (my favorite at that point during freshman year).

I remember poking into some of the labs in the chemical engineering department and [reading] the lively "extracurriculars" bulletin board. This wasn't so "nerdy" after all! Most memorable—meeting Professor Toner (now retired). His enthusiasm and intelligence solidified my impression that chemical engineering would allow me to do the kind of things I liked (math, science, drawing) in an environment more fun than I perceived the sciences (and those drudging grad school TAs) to be.

My freshman year I dated a guy who later majored in "Woody Woo." He fit the classic stereotype of an A.B.—party all the time, do the work last minute, pull off some brilliant treatise. He gave me some grief initially—or rather teased me—"Why's a cute girl like you wasting time in nerdy engineering?" But underneath it, he admired me for taking the "road less travelled" (we're still friends).

My parents were likewise a little skeptical at times but supported my choice. I think they worried a little that I'd be isolated from mainstream life (including social life), but they never let on. And like most parents, they bragged endlessly about their daughter "the engineer."

At that time [when I was at Princeton], I think there were 48 majors in my chemical engineering class. Eight or nine of us were women so it was a reasonably healthy ratio (at least compared to aero!). The whole class got along pretty well. I worked on problem sets with two guys a lot (one a boyfriend), but I treasured my friendships with the other women. Five of us still write to this day (well, at least we send Christmas/Hanukkah cards)—we had a blast at our 10th [year reunion]! Junior and senior year, we all joined eating clubs (Campus, Dial, Colonial,

Cloister) and each week on Tuesday, we'd all go to one of our clubs for lunch. This worked out as a nice way to meet people in other clubs on a regular basis.

Overall, being a woman in engineering at Princeton was very positive. I felt conspicuous at times and got teased, but that was humor. The few negative things actually strengthened my ability to deal with much worse in the real world.

Faith Morrison '83, Chemical Engineering

I am a Princeton engineer and a woman. I really enjoyed my Princeton years and count many B.S.E.s and A.B.s among my friends. I don't think being an engineer was remarkably different from being an A.B. We worked hard, wrote theses, and graduated. The cadence of our semesters were a little different—we worked hard during the first twelve weeks and relaxed during reading period. The A.B.s seemed to do it the other way around.

I came to Princeton an engineer and never changed. Princeton didn't do anything to either encourage me or discourage me from this path. For me, senior research was a very important aspect of my Princeton experience because it got me interested in going to graduate school. I am now an assistant professor of chemical engineering and I love it.

Julie L. Anderson '84, Civil Engineering

Why engineering? At age 18, I was struggling with what at the time seemed much more important than what I was going to major in—teenage angst, sexuality, and religious issues, and experimenting with drugs and alcohol. So, after little or no consideration, my mother convinced me that I could make good use of my above-average math skills and become a highly-paid engineer. At the time, the process was that simple. At one point, I considered pursuing an education in psychology; however, because it seemed the impractical thing to do, I vetoed the idea and stuck to civil/geological engineering.

In retrospect, I realize the things I gained from an education in engineering are organization, problem-solving skills, and perseverance. Seven years after graduation, I feel that my education lacked diversity and color. My favorite classes at Princeton were Religion 201 and the only two psychology courses I took. Art history, music, and languages didn't seem to be options at the time because the required courses for the engineering track left little room to round out my education.

Women in engineering were an anomaly, and I related to the men on a very base level. I seemed to only find male engineering students who had few to little interpersonal skills and related to life on a cerebral level only. Most of my friends were A.B.s who seemed to always have more free time and were able to ex-plore the diverse course offerings at Princeton.

After graduating, I moved to Boston to work for a real estate developer as a construction supervisor as a result of interviewing through Princeton's job placement program. I used only a few of my engineering skills and four years

later, with the crash of the real estate market and a dream to move to southern California, I packed my car with no expectations and headed west and ultimately settled in Los Angeles. Since, I have worked at a health club (Jodie Foster worked out there) and landed a job in the nonprofit arena, working as a fundraiser for the American Foundation for AIDS Research. After a year, I was offered a position at the Gay and Lesbian Community Services Center as a director of a visionary project for lesbians that offers this community a place providing for the educational, cultural, social, and recreational needs by organizing and sponsoring community activities, and by increasing the self-awareness of lesbian lives. I am in the process of preparing for the GREs so I can go to graduate school next year to study psychology and philosophy.

Being a lesbian at Princeton was quite an experience. Not only did I battle with society's oppression, I created my own internalized homophobia, which has been quite a task to dismantle. I knew two other lesbian engineers in my class which made the experience, with the predominantly white male engineering student body, a lot more comfortable than for some of my fellow A.B. gay and lesbian friends who experienced isolation, self-hatred, and fear.

All in all, the Princeton experience changed my life in many positive ways. When I first landed at Old Nassau, from my small-town, middle-class, public-school upbringing, I did not know the proper way to hold a fork, to display good posture, and how to aspire to your dreams in a place where the best had to be good enough for yourself—because chances were that your [best] was not "the best" anymore. I learned humility, to appreciate diversity of thought, culture, socio-economic background, sexuality, and ethnicity.

Caroline Kilbourne Stahle '85, Electrical Engineering and Computer Science

As I went about my business being a science and engineering student at Princeton, I never felt that my gender was an issue. In my dealings with the professors who taught my courses or advised me, or with science and engineering students with whom I worked or studied, I felt that I was respected for my intelligence and potential and that my sex was irrelevant. The only exception to that general statement has to do with comments made to me by [a professor] with whom I usually did not have cause to confer. During my junior year I had a job doing electronic assembly for Professor Gelfand. [The other professor], on at least one occasion, referred to me as "Gelfand's little solderer" and on another occasion asked me if I was "knitting a circuit."

Aside from those mindless remarks, which I could safely ignore, my gender, or more specifically the societally perceived incongruity of my gender with my program of study, was never forced to the fore of my awareness, as long as I stayed within the system, as long as I went about my business of studying math and science and engineering. It was only outside of the system where I found my gender to be an issue.

"You don't look like an engineer!" It was always non-technically-minded

male students who made comments like that. I had stopped dating non-scientists by the middle of my first year at Princeton. I found the science types to be more accepting, more well-rounded, and more interesting. It is possible that being a female engineer evoked on campus no worse a reaction than being a male engineer. I belonged to Cloister Inn at the time when it almost closed because of declining membership resulting from [its] getting the reputation of being a club for science nerds. Despite the image, it was a fun club. Often I felt part of a science underground—a different Princeton with a culture all its own. This society was comprised more men than women, but that didn't seem to matter. I saw both men and women struggle. I saw both women and men excel.

When I dropped out of the engineering physics program, I personally had lost confidence, but I hadn't lost confidence in the abilities of women. After a summer job at the Stanford Linear Accelerator Center, I regained confidence and rejoined the program, earning that engineering physics certificate after all. That certificate means more to me than my diploma. Engineering Physics at Princeton can be rather good at deflating egos. I don't think that, as a woman, I was any more susceptible to that than a man.

Jennifer Haskins Shelamer '86, Electrical Engineering

[With respect to classes,] I should say that I always felt totally accepted as a woman engineer at Princeton. I didn't feel like the men regarded me as any different from them. I think that this is a general characteristic of the young men in America right now. When I feel any discrimination, it is invariably from an older man, one who went to school before there were many (or maybe any) women in engineering. I think that the status of women in engineering will continue to improve in the next 25 years, as men who went to school with women become the majority of male engineers.

I did notice, however, that the women tended to work together on homework. This seemed to be because we worked in the same style. The two or three women I worked with the most usually started the problem sets early, then compared them with each other. This left time for going to see the professor if we were still stuck after consulting each other. It would be interesting to know if the professors notice whether (as a percentage) more women than men came to them for help. I know that one or all of us were in the professor's office every week.

Lots of the men I know started the problem sets the night before they were due and just did their best and handed them in. We (my women friends and I) almost never turned a problem set in that wasn't perfect. I don't know whether these are good generalizations or if I simply attracted people like that around me because I am that way. I do think that women (again, a dangerous generalization) tend to work together more and be less competitive than men.

Speaking of professors, their availability was the *most* positive aspect of being an undergraduate engineer at Princeton. I don't remember even one who worried about whether we came to see him during his office hours. In my

junior year, I took an upper-level economics course. I had difficulty with one of the problem sets, so I dropped by the professor's office. He very grudgingly helped me, then told me to come during his office hours next time or to see the TA. I was shocked, because no engineering professor had ever asked me to come during his office hours, and we almost never went to the TA because the professors were so available. They really had time for the undergraduates, and the quality of teaching was *much* higher than it was at Berkeley, where the emphasis is on research.

It is possible that other women have felt gender discrimination more than I have. I have always assumed that I could do whatever I wanted to, regardless of my gender, and because of that attitude, discrimination has to be really obvious before I notice it (as an example, my last manager said to me, "I don't know what to do with you because you're a woman. If you were a man, I'd chew you out, but since you're a woman, I don't know what to do." Pretty obvious.). I think that Princeton encourages students to have confidence in their intelligence and their knowledge, and a confident attitude discourages discrimination. I *know* that I am as good as any man, and I know that that comes across when I interview for a job.

I sometimes think that the Princeton experience must be better for an A.B. than for an engineer. Since we had to take more classes, we were always working harder (except maybe during senior thesis time). There were a lot of things that I never did (for example, the only time I went to the Art Museum was when I took Art 101) because it seemed like I was always doing problem sets or other homework. Most of my friends were engineers because we spent so much time together either in labs or doing homework. My roommates were jealous of me because I spent more time with their boyfriends (all electrical engineers, curiously) than they did. I remember one instance when my roommate was jealous that I was going to take a physics midterm with her boyfriend!

Most of my extracurriculars were outside of the engineering school. I felt that I spent quite enough time with my engineering friends, and I needed a break. I still hesitate to get involved with technical societies; I'm with engineers all day long, and I appreciate other points of view when I'm not working. However, I live in Silicon Valley, and it sometimes seems like everyone is an engineer!

Diana Bauer '88, Mechanical and Aerospace Engineering

Most of the men in my family studied engineering in college. Since I was good at math and science in high school, it seemed a natural thing for me to go into. I went to an unusual high school where the male/female ratio in math and physics classes was pretty even. It wasn't until later that I began to realize how difficult it is to be a woman and an engineer.

The stereotypical engineer is conservative and distinctly unfeminist. Since there are so few women studying engineering, it is very easy for men to avoid working with women and to treat their classes as male bonding experiences. In

many of my classes at Princeton, women were on the fringes socially. This put women at a definite disadvantage junior and senior year, when much of the work for classes was done in small groups.

It was junior year when I began to question the philosophy of engineering. I remember one class the first semester of my junior year which I found particularly disturbing. There were 20 men and two women in this class. It was taught by two men from industry. These men had a habit of referring to engineers as "he" and secretaries as "she," which I found annoying. After turning in our first set of reports, the class was handed back a list of general comments and suggestions. Among them was, "Use aggressive and assertive language; no motherhood or apple pie." In class presentations, an important skill stressed was "covering your ass." These men from industry did not use this expression, but the concept was certainly there, and I've heard it used many times since by male classmates.

It is expected for students at times to have problems with classes or disagree with how they are taught. I didn't feel that these men were trying to make me feel uncomfortable; it's more likely that they didn't know any better. What was unfortunate in this case was that I felt I had no one to make constructive complaints to. There was no prescribed path for voicing one's feelings about such things within the E-Quad.

Today, I may be self-assured enough about such things that I would go directly to those two men, but I certainly wasn't then, nor should the school have expected me to have been. It is entirely likely that these two men unintentionally contributed to the alienation of women in later years as well. Due in part to my own stubbornness and disillusionment, I didn't learn much in that class. (This probably reinforced any negative views those two men may have had about women engineers.) I liked to say afterwards that the only thing that class taught me was that I didn't want to work for the company that those two men worked for. This wasn't completely true, but I know I would have learned more if I had felt more comfortable.

I was the only woman in a class I took second semester of my junior year. This particular class was a very intense lab class. At the end of the semester especially, it was necessary to put in very long hours. As I entered lab one evening, I was half-jokingly accused of spoiling the male bonding that was going on. Generally I didn't spoil the bonding though: as I worked quietly at my lab bench, some of my neighbors complained of their bitchy girlfriends and bragged of their beer-filled weekends. My lab partner told me that the guy next to me had a much cleaner mouth on days I wasn't there. As I spent time in this lab, I worried that I would have to spend my life working with people like these. I found the whole thing quite upsetting because I didn't know what career I would choose instead, and it disturbed me that I would let something like social environment sway me in my career decision. If I and others like me did this, the social environment would never change. Besides, engineering was supposed to be so rational, so separable from the people doing it. I was finding that it wasn't.

My independent work was a flop. My partner, my adviser, and I just didn't quite hit it off as a threesome. I wasn't pushy enough back then. I assumed that everyone got things done on time because I always did. I wish I had been more assertive and my adviser had been more available. I also wish I had selected the project myself and worked alone. This ordeal frustrated me, but didn't crush me. I resolved to learn from it.

Senior year I discovered linguistics. I found an adviser who wanted to spend time with me and listened to me and respected what I had to say. I discovered that this made all the difference in the world. For a while, I considered going to graduate school in linguistics, but I decided that the field was too narrow for me. Ironically enough, I think it was my positive experience in linguistics which helped me decide to go to graduate school in engineering. Linguistics showed me that I really did like research. I decided to give engineering another chance at another school with another adviser.

I was not all that unhappy at Princeton. Nearly all of my friends were non-engineers. I enjoyed being able to take a variety of liberal arts classes. I played the flute in an assortment of music groups. I was very active in intramurals. I volunteered at a day care center in Trenton. I was on a variety of committees, including, briefly, the mechanical engineering undergraduate committee. Looking back, the problem that I see with organizations in the engineering school, including SWE, is their purpose seemed to be to make sure that things continued to run smoothly. No one wanted to make waves. (I cannot say with certainty that I would have wanted to make waves back then either.)

Between Princeton and graduate school at Berkeley, I spent a year teaching English in China. This was, at times, a very trying experience, but I'm glad I did it. In China, I regained much of the self-confidence I had lost at Princeton. I was also able to broaden my view of the world again. One of my major gripes with engineering today is that it tends to narrow people's view of things. Spending a year in China gave me time to think about me, my life, and what I hoped to accomplish.

My year at Berkeley for my master's degree was a more positive experience than my last two years of studying engineering at Princeton. Still, I didn't fall in love with engineering by any stretch of the imagination. I believe I was happier because I was more determined to talk to professors and more willing to ask questions. I had more friends who were engineers. My master's thesis was nothing outstanding, but it was relatively solid, and my adviser and I got along fine.

Now I am working at a mechanical engineering research firm in Boston. It is small and informal. I am able to work on a variety of projects and I like that. I find that I am respected more as an individual with my own personal quirks (since I get my work done) than I was in my engineering classes. Still, I feel restless and intend to move on eventually.

I have become strongly anti-establishment in my years since Princeton, as have many of my women friends. I am becoming increasingly concerned by the

tremendous gulf between technological "evolution" and societal concerns. I find technological evolution a curious term: it makes it seem as if we have no control over where technology is going. To the contrary, it seems to me that the direction of technological development is controlled by those people and institutions who have power and money, typically not those who are concerned about homelessness, the environment, and Third World famine.

I plan to make a career shift in a few years. My ideas of what I'd like to do are vague, in part because I know of no one who does such things. One idea is international technology policy, trying to figure out ways of making the lives of people of poorer nations more comfortable, without contributing to global energy and environmental problems. Another idea is educating science educators. Recently, people have been brainstorming about how to support and encourage girls so they will go into science and engineering in greater numbers. Instead of trying to change girls so they fit into science, I'd like to help change the conceptions of scientists and engineers, so that it is considered acceptable and even desirable to be an engineer or a scientist with a social conscience. Then maybe we'll see some innovative technological tools to help us solve the many social problems which plague us, and maybe people with societal concerns who are good at science will become scientists and engineers.

These kinds of views are often labeled naive and idealistic, but I think this kind of labeling is at least partially a rationalization made by the people who are already comfortable with the system. Personally, I'd rather work at changing a system I feel uncomfortable with than at trying to fit in it.

Anonymous '91, Civil Engineering and Operations Research

I am a senior here in the School of Engineering. I came to Princeton from a small town in the Midwest. Overall, Princeton has been a wonderful experience, and I feel deeply grateful for this opportunity to broaden my horizons. (Gawk! This is beginning to sound like the thank-you letters I write the financial aid dudes. . .) I will try to focus on the female side of my experience.

Freshman Year. As a freshman, I was incredibly high on life. I was excited out of my mind to be here, and I loved being an engineer just because it was part of my Princeton identity. I would go around telling people I was a freshman engineer, and expecting to hear oohs and aahs when people heard I was a "woman engineer." It worked okay in my hometown, but Princetonians were pretty much unimpressed. Their attitude didn't dent mine, though; I guess that is the perk of being a freshman.

I was very timid when I came here. I made friends quickly because I was also loud and bubbly and talked a lot, but I hesitated to stand up for myself. I would agree politically with anybody's views, any views, even two contradictory views. I now think it has something to do with how I was raised: subconsciously, I had the idea that I was supposed to be sweet and loving and kind, and the men were supposed to go to battle with the world. I took great

pride in being our neighbors' "favorite" babysitter and loved it when people told me I would make a great mother and wife someday. I also thought I could get along with anybody, and was proud that my personality was nice and gentle enough to be completely inoffensive. This is a sort of subconscious slant that I think I just absorbed at home. This carried over into my being timid. I identified myself as sweet and nice. Consequently, I was afraid to stand up for myself. I would keep a pair of pants that didn't fit rather than take them back to the store for fear of hurting somebody's feelings—even the saleslady's! I would lend people money and be afraid to ask for it back, for fear that they somehow wouldn't like me if I did. And freshman year here, I was afraid to go to my physics professor's office hours because I felt I was imposing too much upon him.

One spring day in physics lab, I wore shorts to lab. Soon my (rather repulsive) lab partner was brushing against my legs and touching them. By the end of the lab, he was running his hands up and down them. Instead of being infuriated that this creature would do this, I was sort of emotionless. We just turned the lab in.

Sophomore Year. I had not dated a lot in high school, and so I was very much into that idea here. I liked men and I liked to go out with them. I liked male attention, even from "just friends," in the form of hugs, high fives, back rubs, etc. In retrospect, I was a much bigger flirt than I would have admitted at the time.

Experience speaks about dating your lab partner: *Don't!!!* If you must, wait until the class is over. I have done both, and waiting until that semester is over and he is no longer "The Lab Partner" has worked out much better.

Late one night, I was in the confines of the computer lab. There were my fellow victims and a few upperclassmen there. It was late, about 3:30 a.m., and I was the only female in the lab. (There was one other woman in the course, but she had much better study habits than I did and was done.) I was headed to get a printout of "The Program From Hell Which Will Never Ever Ever Work" when I felt a tug at my elbow. It was one of the older guys, and he had pulled up a graphical picture of a well-endowed, lascivious woman on his screen. He asked me if it offended me. I said yes, it did. He laughed and said, "too bad!"

I said earlier that I was acutely aware of being a female surrounded by males. At times, when I was in flirt mode, I would wear makeup and actually do my hair and try to appear female. I also went through the other phase: times when I would try to appear "One Of The Guys." I would wear shapeless T-shirts and jeans, no makeup, no jewelry, no anything. I would laugh at their jokes, even those which referred to past conquests of women or to their own prowess or size. (You wouldn't want me to repeat them here!) I would never tell any, but I would laugh instead of telling them that they were being insensitive and offensive.

I discovered SWE that year. It was a great networking experience. As a SWE member, I was also accused of being racist, sexist, and of having unfair job opportunities because I was a woman. I believed it and dropped it soon thereafter. I picked it up again [since], and have been glad I did.

I gained a lot of confidence sophomore year. I had a stronger identity as a person, not just as an engineer or as a woman. I began to become very angry instead of becoming depressed. I began to insist upon my half of the pie. I did my half of the lab, including the hands-on stuff, where in the past I had let my partners just do it because they seemed to do it better or more quickly.

Junior Year. At one SWE luncheon, a random guy walked into the lounge. He exclaimed how out of place he felt, being the only man there. It was an interesting switcheroo!

By this time, professors and grad students have mistaken me for a secretary or a Xerox machine operator several times. I have had to give their "orders" back to them and explain that I am also a student and will not do their xeroxing.

A new crisis hits my life. All my high school friends are married! They are having bridal showers and baby showers and all sorts of wonderful cuddly domestic things. What's wrong with me? I can't even hold onto a boyfriend for a while without fighting with him! I feel a lot of pressure to become engaged. Suddenly my [differential equations] book looks very hollow.

I finally told a professor that I was too sick to complete his assignment on time. I got my first extension! In the past, this fear of professors had paralyzed me. I took exams with a 102-degree fever; I took midterms with nauseating cramps; I wrote term papers in consecutive all-nighters because they were all due at once.

I identified another dichotomy between men and women. When many men don't do well on a test, they tend to say something like, "The professor couldn't teach!" or "The damn test is unfair." Women, myself included, tend to say "I didn't study hard enough," or "I am sooooo slow and stupid!" I try to break myself of the slow-and-stupid habit and go on the offensive against incompetent professors who give unfair tests.

With my disbelieving roommates, I identify still another big thing: PMS! We had all conceded that cramps were real and significant. However, we had not recognized the tension and irritability and difficulty of concentration which go along with it. The typical response was some bloodcurdling shriek along the lines of "*Dammit,* I do *not* have PMS!" Self-incriminating . . . I also began to become upset with men when they would shrug off some of my actions with a smirk and a muttered "PMS." Some men I knew used it to explain anything assertive or aggressive I did. In fairness, some men are wonderful about the whole thing and never mention PMS as a justification for my actions. My boyfriend is great, too: he expresses sympathy for the cramps and leaves it at that.

Senior Year. "The Interview Suit" has now materialized. I need a job and I realize I am going to have to get it. I have the damnedest time finding the "Interview Shoes." I just want non-painful, professional-looking shoes. I am moderately tall and look ridiculous in two-inch heels. Even were I shorter, I cannot balance in heels. All the flats I see belong either on an LA beach or in Greenwich Village. There are black rope sandals with bells on them; there are $200 snake- and alligator-skin slingbacks with an open toe; there are these bright

shiny patent-leather shoes with laces (yay!) and huge gauze bows on top of them. All very well and good, but *not for my interview!* I have the same problem with interview shirts: they are all transparent and I do not like to show my underwear off to everybody! Solution: a beige bra and a man-style white undershirt. (Try it, you'll like it, too!)

At a Princeton Club Luncheon in my home state this fall, I mention that I am an engineer and need a job. One of the men there says he needs a secretary. 'Nuff said. I learn to talk to recruiters and feed them what they want to hear. It's a good feeling to waltz into Career Services with a company nailed.

I am getting more and more assertive in my old age. I ask somebody in a computer lab to be quiet for the first time. I am elated and surprised when the offender apologizes and clams up.

Big marriage crisis. I decide I will *not* get engaged now, nor will I take a job based upon the boyfriend's location or future plans. This is the first time I truly realize that I must get a job and do it all by myself. Although I thought I broke the Midwest Mindset long ago, it continues to haunt me. But this is another piece in the wall broken down.

In closing, let me say this has not been intended as a feminist, crotch-snipping rampage. I like men and will continue to live, work, and eat with them. I have tried to give a picture of what my Princeton life has been like because of being female. I have not run into too many cases of overt sexism or harassment. However, I do think that the traditional female outlook blames the self instead of the world, and emphasizes being nice and sweet instead of having self-respect. This outlook has shaped my Princeton Experience immeasurably, just as my Princeton Experience has shaped my outlook on the world. I think my time here has made me less traditionally female and more aggressive and assertive. That's a good thing, though! It's a man's world.

Jennifer Bonini '91, Civil Engineering/Geological Engineering

I was recruited for lacrosse and field hockey. Everyone told me that with engineering I couldn't do more than one sport. Unfortunately, I said, OK, I'll just do lacrosse. I wish I had done them both at first because then I could see which one I would have preferred. I ended up doing lacrosse, not really liking the coach, and that was it. I wasn't going to try to pick up field hockey and deal with an engineering sophomore year—especially since I was one of two engineers on the team and the other one quit. When I was the only engineer, I had to apologize every single time I had to come back from lab. The coach said, "How long are you going to have these lab things?" What was I to say? Engineering was why I was studying here; it was my major.

That was something that definitely skewed my perspective. There are so few women engineers in the sports I was in. I was one of the few engineers in my club—probably the only female engineer, and that's a different perspective, depending on where you end up on Prospect Street. That's another thing where

being both a woman and an engineer is different.

This year I took on an officership at Cap [and Gown]. I was one of three officers who were female and only one of two who lived at the club. Being House Manager was a big responsibility and a lot of work.

There was a funny incident during elections: All the candidates had to stand up and make little speeches for the position. There were two guys and me. The first one started off saying, "I'm an engineer, so I'll be able to fix things." Then the other guy stood up and spoke and at the end of his speech said, "Oh, I'm also an engineer." Then I stood up and talked about why I wanted this position and ended by saying, "Well, and I'm an engineer, too." It was kind of funny. Again, we were playing on more stereotypes: I was the first female House Manager, which is traditionally a male position, but since I was an engineer, I was more justified in the position. I thought it was an interesting situation, but I'm probably making more of it than it's worth.

Robin Katz '91, Civil Engineering and Operations Research

I was in a construction class—one of four other women in the course—and the professor was showing some slides that he had taken at a construction convention. They were pictures of front-end loaders and such, and then all of a sudden, there were pictures of women [models] on the equipment. These were followed by a series of pictures of them from behind. Apparently [the professor] had been following them. What was the purpose of that? He could have taken them out before he showed the class. After a few slides, the professor laughed, "Oh, a little cheesecake." The guys in the class also chuckled, while I leaned over to my friend and asked her, "Did you see that?"

Another instance seemed a little weird, too. It was the same construction class, and the professor pointed to a woman—who happened to be the only black woman in the class—and said, "If I told you I'd give you $10,000 to come back to my office, but then I tell you I don't have it after we get there, is that a breach of contract?" I thought it was a little weird to be singling someone out to make that particular point, especially the only black woman.

I used to love it when people said to me [incredulously], "You're an engineer?" But now I am offended at the stereotype [they imply]. They're the same as the stereotypes about being from Princeton: You're rich, bitchy, super-smart, and stuck-up.

I didn't want to be connected with SWE, even though I had gotten a scholarship from them based on my high school preparation. For the first two years, I avoided all engineering extracurricular activities. Part of this decision was the [fear of being] stereotyped. People have their own priorities, and SWE's weren't mine.

I was one of the people who tried to revive ASCE (American Society of Civil Engineers). We knew what we stood for but we had a problem with apathy. I

don't think it was because the students are bad; it's just that there are bad motivators. A lot of students got [into Princeton], especially the engineering school, because they put themselves first. This tends to take precedence over other activities.

I find that I'm never myself in classes. I didn't feel comfortable asking some professors questions. They made me feel like an idiot by saying "Isn't it obvious?" I didn't have the confidence to ask questions (until this year), mainly because I didn't feel encouraged to ask them. Certain fields have assumptions about intellect: The instant response of some of the new professors who think they are teaching [the material] right is, "Why are you asking?" [Because I missed the junior fall here, I'm now in new classes], with new people and no one knows me, it makes it easier to ask questions in a formal classroom.

When I first came, I didn't talk much during classes. In [public] high school, it was not cool to ask questions in class. You shouldn't pay too much attention either, at least you shouldn't appear to do so. I learned that the private school [students] have the opposite attitude, which is required to do well.

I went to classes with people that I'm intimidated by. It seemed that we all set up boundaries to isolate ourselves from others. Social and study groups usually formed sophomore year and usually stayed together for the next three years—not a lot of people broke out of them.

I didn't really meet my friends through classes. I met my friend Diane through problem sets, but in general, I didn't feel comfortable in class. It seemed that all my classmates were in bicker clubs, dressed well with jewelry and eye-shadow, and looked down on me. Although I didn't want to be bookish, I didn't want to be with them either. But I'm giving the wrong impression of my classmates.

It was because I assumed that they were unfriendly that I had this attitude. I didn't really make an effort to say hi. But we are friendly [now] because thesis time brought us all together, and we're all graduating soon, so why not be friendly?

During thesis time, we were all [at the E-Quad] at 3:00 a.m. There are no social pretensions when you look like shit. I also got a better sense of myself by going away [to Australia] and then coming back.

I can stand up now and say "Hey, I'm an engineer" and not worry about the stereotypical associations. I was in real fear about that before. A lot of people come in sensitive (or overly sensitive) of being stereotyped from various insecurities and images of negative association as socially maladjusted engineers.

My B.S.E. degree is like my battle scar, [indicating] what I've gone through. I've gone through a lot, too. I developed an eating disorder sophomore year. I was bulemic when I was on campus. I don't know if it had to do with being a woman engineer, but whenever I was on campus, I just could not keep anything [down]. This place puts extreme pressures on people.

I will never be sorry about choosing engineering and Princeton. Part of what

I learned from Princeton was an attitude. People here are very accomplishment-oriented and confident. They work hard and play hard. It was a change from the "Oh, I can't do that" attitude [I found] in high school. A lot of that attitude has to do with Princeton. I went to Australia junior fall and found that the work method was different there.

I feel that I wasted a lot of the opportunities; there seemed too many, and I had to choose. I realize that the level of education depends on the level of effort you put in. Here, we have the opportunities to work with great people, but you have to work hard to get onto their projects. Others can get this same educational opportunity with a professor at another school, but it seems a shame that they don't get the Princeton or big-name recognition.

I look back on my Princeton experience with mixed feelings. If I had a child who wanted to go here, I'd ask her to take time to think about it.

In engineering, I never was made to feel that I couldn't do it. DeVeaux and Powell took my personal concerns about not wanting to go into research as valuable and helped me out a lot. DeVeaux told me that not everyone should be here or go to grad school. It was reassuring when he told me, "If you don't want to [go to grad school], you won't do well." He was telling me things that I knew, but it was nice to hear him say it.

Schizo

(dedicated to weekly problem sets)

You're so wrong
The conversation escalates;
The voices intensify;
The hands reach for
    pens, pencils, paper, napkins...
Scribbled marks
    to represent the given,
Arrows to show the obvious,
Conclusions fall out
like rabbits from a hat.

Lost in the confusion,
Overwhelmed
by the onslaught of logic
(faulty or true, it makes no difference),
I listen silently;
I am humbled, I am learning.

Or
I jump into the fray.
Bursting with energy,
Wrong! I shout back,
and mete out
my scribbles,
my arrows,
my conclusions.
I am psyched;
I am confident, I am learning.

Don't form opinions too quickly
Lest you be wrong.
    Just wait.
Wait! Wasn't that wrong?
Wait! That's not quite logical!
Wait.
Silence is a virtue.
How will you learn if you don't listen?
How will you listen if you don't hear?
How will you hear if you talk?
Just wait.

Fight with logic,
Overwhelm with jargon,
Snow.
I'm right . . .
The last one standing
(over a battlefield of broken logic).
What a thrill.

And yet,
in the furor is merely a clone
who argues with my voice
    and uses my hands.
I don't like her very much
(a real bitch, that one).

But what about . . .
A simple question posed.
That's trivial!
A responding tone of insistence
    with a tad too much confidence
        for someone's better taste.

<Detonation>
All is lost.
> The sirens blow <

It's every man for himself.
Stragglers are left behind.
Grab your sword
    and jump into the fray again.

But wait,
Does the scuffle—
Brandishing pencils,
Hurling logic
    (with that hint of insult)—
Make you laugh the child's laugh
When she watches
Adults argue
    over who left the toilet seat up?

You're so wrong
Voices rise;
    Hands move to...
—But wait,
Just wait.
Remember your goals? your dreams?—
Why you're here?
A chuckle will set the mood
To learn.

—Yvonne Ng '91,
Mechanical and Aerospace Engineering

Amy Niedzielka '91, Electrical Engineering

When I reflect on my four years as a woman engineer at Princeton, my mind scans a panorama of images and remembrances, very few of which, I can honestly say, my male classmates did not also experience. The men attended just as many labs, did just as many problem sets, and took just as many exams as the women. However, when a break from the academic strain was needed, when a temporary exodus from lab was the difference between sanity and the grad student mentality, the guys went in one door and we in another. My favorite refuge was the one on the first floor of the C-wing.

The Engineering Quadrangle women's bathrooms, as a whole, are far superior to any other bathrooms the University has to offer. They aren't as numerous as the men's rooms, but they come stocked with mirrors (small and large) shelves (convenient for backpacks), and chairs (convenient for backpack-carriers). The stall doors all lock. You have plenty of knee-room. And it is a credit to the engineering faculty that there's not a speck of graffiti to be found. If engineers were given humane amounts of work to do, then perhaps women

would sit in the stalls longer and color the walls as the liberal arts majors do. As it is, they have barely enough time in the bathrooms to collect their thoughts and recharge their brain batteries.

Sophomore spring, my lab partner Jennifer and I figured we had set some sort of record by spending 13 straight hours in lab, from 1:00 p.m. to 2:00 a.m., on one occasion. We reconsidered when we realized that eight of the 13 hours had actually been spent BSing in the bathroom. It was that spring that the women's room—the "Hole" as Jennifer respectfully named it—came into prominence as far as we were concerned. Working on one computer terminal, together, day and night, hour upon hour, in an oxygen-less underground lab (affectionately termed, by Jennifer, the "Rack"), we would hold out until I was ready to commit suicide, and she murder. Then we would lumber down the hall, up the stairs, and down the hall, to the Hole. Or, for variety, up the stairs, down the hall, and down the hall. There, after somberly attending to matters that needed to be attended to, we would slink down into two of the chairs, put our feet up, and sigh a few times. If things were going very badly, we'd probably groan, too. (We did a lot of groaning.) We would have cried if we had had the energy. We felt about as pathetic and forlorn as two floppy-eared puppies cramped in a pet store cage must feel. But at least those puppies have hope.

We would eventually gather the strength to espouse the current distress, analyze it, and propose a solution, and then, somewhat rejuvenated, we would arise ready to go back to work. Sometimes we would be ready to get back to work, but we wouldn't hurry. We would sit back down, as there were always other concerns, besides our computer problems, to be discussed. Our social lives, for examples. Or, our future lives. Our roommates. Our roommates' lives. Our sex lives. (Sometimes the conversations were brief.) Soon the computer lab seemed more than two hallways and a staircase away. . .

Plop. A look at our watches would end our fleeting ride on Cloud Six (it really wasn't any better than that), and send us plunging back to earth and that abominable basement. Sometimes about 10 minutes had gone by at the conclusion of our discussions, but usually more. They rarely lasted longer than an hour or two.

With heads held high, we would return to the Rack, and then, after a while, we would get up again, pale, deflated, and utterly exasperated, and the cycle would repeat.

Jennifer Rexford '91, Electrical Engineering

For the most part, my interactions with faculty and graduate students were positive. I never felt that any of the professors or teaching assistants discouraged me; in fact, many of them were encouraging. Some professors were more approachable than others, but they were all accessible. I had several TAs who were wonderful, helpful, and dedicated. Many students were critical of Princeton engineering TAs, but I had very good experiences. Several TAs went far beyond

the call of duty—staying in lab extra hours. I don't think good TAs get the appreciation they deserve. I did have one TA who was kind of annoying. I went to his office one time to ask a question about an assignment; he had a large graphic of a naked woman on his computer screen, which made me a little uncomfortable. Except for my encounter with this one TA, I had very valuable contact with teaching assistants.

Experiences with my classmates took a variety of forms. Over the years I made many good friends, both male and female, in the engineering school. I think the junior and senior years were better in this respect. During sophomore year, my roommates used to joke that Sunday night was "Jen and Men" night; problem sets were due Monday mornings. It was frustrating to be popular company only the night before a problem set was due. That pretty much ended by junior year, when we all started taking more specialized courses and moved out of the residential colleges. During junior and senior year I met more people—in class and at the eating club.

The computer network has a culture all its own, with a small handful of eccentrics. One night during my freshman year I was up late working on a computer program that was due the next morning. Someone working in another computer room periodically requested to "talk" (electronically, over the computer) with me. The first few times I talked with him for a while, before I would continue working on my assignment. After he had "talked" with me five or six times, I told him that I really had to finish my assignment and I didn't have time to talk. He then sent electronic mail to one of my classmates, complaining that I wasn't paying enough attention to him and that he was plotting "revenge."

For the next hour I received electronic mail in an infinite loop; the guy wrote a program to bombard me with electronic mail every three or four seconds. Needless to say, this disrupted my work. I had only been using the mainframe for a few weeks, so I wasn't sure how to stop him. It was four in the morning, so the computer center wasn't open. Fortunately, there was another person in the computer room. Through his account, he sent the jokester mail, telling him to stop acting so immaturely. Eventually, I stopped receiving mail. The next day I reported the incident and the guy's login name. Later, he sent me mail apologizing for what happened and insisted that he hadn't really done it; that someone else had borrowed his account.

Certainly, not many people behave this way. In fact, in my experience, only an extremely small handful do. Still, when it happened, it was disturbing. Nothing like that ever happened again. A few times I received mail from engineering students at other universities. They would see who was logged on at phoenix.princeton.edu and send mail, or try to "talk." I guess they would see a female name and decide to try and strike up a conversation. One guy from Carnegie-Mellon was particularly persistent—he asked me if I was good-looking and wanted me to send him my picture! I met an engineer from another school who told me that, at her school, some of the guys have "fake" female names on

their computer accounts. When another guy would try to "talk" to them, they would play along and have a good laugh.

The opportunity to do independent work with a professor is one of the best aspects of Princeton engineering. In fact, it was one of the reasons I decided to come to Princeton in the first place. The exposure to research and the one-to-one contact with a professor was invaluable. The EE department even paid the costs for me to attend a technical conference.

Another important part of my "engineering experience" was developing friendships with classmates. Engineering, more than the liberal arts, gives you the chance to work with other people on problem sets or projects. Invariably, work on labs or problem sets would end in conversations about anything and everything. That was how I had envisioned "college life."

Amy Fronduti '92, Mechanical and Aerospace Engineering

There's much more of a bond among engineering students in the same major than in a lot of other majors. You can never write papers together, but you almost always do problem sets in a group. Projects are group projects. As the group gets bigger, it gets harder to do, but it's worth learning. From what I've seen of "the real world" no matter what kind of job you have, very rarely do you sit in a corner and write a paper by yourself—A.B. or engineering.

The only other major I can think of that does anything in groups is the Woodrow Wilson School. They work occasionally together—one of my roommates is Woody Woo —but the group dynamic is not as consistent or as integral an experience.

I played water polo my freshman year but haven't had time for that since. [Involvement] depends on how important things are to you, and I'm very involved in Princeton Evangelical Fellowship (PEF). This year I'm secretary and publicity chair. Last year I never would have had time to be anything but a member, but things are getting a little bit freer, and I've been really involved this year. It's something that's very, very important to me. The organization itself is not more important to me than my school work, but it is something that helps bring me closer to God. This is so important to me that it sometimes tends to take precedence over my school work.

I think we [engineers] tend to have more fun in our non-technical classes, because for one, they're not as serious [toward our major] and two, they're different so we can put a different kind of energy into it. I sometimes feel that I get more out my one A.B. course a semester than your general A.B. student will. I haven't taken as many humanities as I would like, but I've also taken [a lot of] technical courses, whereas most humanities people have [only] their two lab courses which are probably Physics for Poets (Physics 111/112) and Psychology.

It's been neat to identify with your department early as well. I've noticed this bonding coming out of A.B. juniors now. We experienced it earlier because the work load was harder as sophomores, and you knew who your classmates were

earlier. The bonding is a neat thought; some call it Engineering Elitism, but it carries you through your first two years. It gets you to keep telling yourself, "I can do this! I can do this!"

It's different, too, how the whole engineering building and MAE wing [are arranged]. If you're a history major, your classes are scattered everywhere, and you don't walk by your adviser's office all the time; you don't have the sense of everything being right there.

Here, you get to know grad students because you see them in the halls all the time. You get to know the professors because they say hello to you in the halls; it's more of a community feeling. I think it's a neat experience. You know professors who aren't even your advisers because you see them in the hall or have classes with them. I know that this community feeling exists in some of the smaller departments, but we're a big department—[55 or something junior MAEs]—and the fact that we still achieve that sense of bonding is rather incredible.

I haven't for the most part had any problems [being a woman]. It doesn't bother me if the professor learns my name because I'm a woman. I'm just happy that he's trying to learn names. If my looking different helped him, then it's kind of nice that somebody learned my name and actually cares.

I've found for the most part that the professors that I've had do care. I go into their office, and they say, "Hi, Amy. Can I help you?" That's been really nice, and I haven't felt very much condescension. I did have a run-in with a TA last semester. [My friend] Kathy and I were doing a project in his class, and I think we both felt that he was treating us a bit like second class-citizens or with a "Well, of course you two can't get it; you're girls" attitude. I wouldn't exactly have called that sexual harassment, but it was borderline.

At the end of the semester, we were in his office talking to him, and I got pretty visibly upset: He had told us the day before, "Well, this is just about right; do some write-up and hand it in." And then when we went in to show him again, he said, "No, no. This is totally wrong." And I just turned to Kathy and said, "Maybe this isn't worth it." Then he came and put his arm around me to comfort me, and that's not something I want from someone I don't know. I tried to remove his arm, and he wouldn't let me do that. It upset me a lot—it's nothing I would consider awful enough to report for discipline, but it did upset me. But that's the only time I've run into that attitude. For the most part the grad students and professors have been very welcoming and very helpful.

I'd have to say as a whole the experience has been really positive. I have not experienced very much sexism at all. This was just one incident. It's harder to detail all the good stuff: I can't say, "Oh, I went into Professor Mease's office and he was really, really helpful" sort of thing—this happens all the time, so it's not "interesting."

For the most part, I tend to laugh at that sort of thing. I found it neat when some of the older professors discussed these things with me, because it shows that they are trying to understand and make adjustments. Those are the ones that you

would expect to think, "What are women doing in this building?" They have been very accepting.

It's funny that the one run-in that I have had was with a grad student who you would expect to be young enough and with-it enough not to pull that sort of thing.

Katherine Haskell '92, Electrical Engineering

When I was a freshman, I got hosed in a couple ways. I didn't know what was up with things and it destroyed my confidence. Freshman year is a really bad time to lose confidence, but luckily I managed to pull myself out of that during sophomore year.

I ended up with a really bad math instructor my first semester here; he basically destroyed my confidence in math—I was a basket case. I had no idea that I could switch math classes or anything, and I never saw my interactors. Looking back, I realize that if they had just talked with me or something, I could have found out about my options.

Freshman year is very important in a lot of ways because it determines your future frame of mind. There are a lot of students who, though they might not drop out of engineering, can form a negative mind set.

It's very easy to lose confidence [with that kind of attitude], and engineering is one of those things that if you don't have the confidence going into a problem set, especially with the theoretical bent they have here, you just can't get the problem done.

Since I've been an interactor this past year (and will be one this coming year), I've thought a lot about how I would want to change what I went through—how could my interactors have changed what I went through my freshman experience at Princeton?

The nice thing about [the Princeton experience] has been the students. I don't know how it is with other universities, but I've been really happy with that. I never "got together" with people in high school; I'd be on my own. Here, everyone just seems to come together, and if you have a question, you ask someone else. Each person has their own little special field. There are some classes where I'm the one people ask "What's going on here?" There are other classes where I'm the one [who's confused].

[Study groups] seems to be a part of the liberal arts perspective coming into engineering: interaction and exchange of ideas. They seem to be common in an English class precept, and the fact that it extends into engineering is really neat. Other schools have stories about cut-throat competition where students don't work together on problem sets or ask "How did you do this?"

This is kind of random, but I love the CS Building; it's like my home away from home. Some of my best memories of working on problem sets and things like that [are associated with that building]: getting together on the third or fourth floor of the CS Building in the classrooms which have been open all night.

Going there, getting together with my friends and working on problem

sets was such a bonding experience. It's one of the few places on campus that's comfortable, quiet, etc. It's also a [good] place to meet other engineers. The E-Quad has never really quite been like that. There's no place in the E-Quad to go, whereas the CS Building is built entirely for interaction. The only places in the E-Quad for that are possibly the library and the lobby, and the library [doesn't allow talking].

The CS Building has nice large tables, rooms with phones in them, and computer facilities right there where you can run and print out your lab report. It's a great place, and it's going to be a real shame if they lock it up overnight like they've been talking about. Apparently, [some people in the administration] are getting upset because people are staying there late.

Susan Kim '92, Electrical Engineering

I get very disheartened with electrical engineering because I'm not at the top of the class and everyone at Princeton is so obsessed with doing well. It always happens that when I seem to flag and have some trouble, someone in the EE department does something on a personal level with me. It seems like someone in the department cares, which is sort of silly, but it's comforting.

Sophomore year I was having some difficulties in [Prof. Bradley] Dickinson's course. Dickinson was kind of gruff, but he'd be around. If I was worried about something, he'd talk to me. There were sometimes that I'd be up in the area and he would check to see if I wanted to talk to him, just because he knew I was usually a person who needed to talk to him. It was comforting.

Sometimes I would ask him some of the dumbest questions, but he would still actually consider them and try to figure out what I was *really* trying to ask him. There was one time I went in to talk to him at the end of the year. Afterwards, he said, "Well, I'll be around tomorrow after 8:30 because I have to get up early and drop my son off at kindergarten." He didn't have to say that or anything; it's nice to know that your professors are human.

This year in EE 420, I didn't do really well on the midterm, so [Prof. Wayne] Wolf called me in by writing "See me" on my exam. He sat down with me, and we worked through some of the problems. I really appreciate that a lot. He also helped me find a job this summer at AT&T. I'll be running simulations and doing a lot of "slave labor," but it'll be good exposure.

It's hard to bring yourself to go talk to professors. It's interesting because I have talked to a number of professors. I'm still not really sure what makes some of them more effective for me than others. One professor is a really nice man—understanding and so on—but I found it harder to talk to him than Dr. Wolf. I think that when I did badly on the midterm for Wolf, he viewed it as something that was totally fixable, even if I had never taken any computer courses before. It was possible that I could save myself in the end.

The other professor seemed really worried that I wouldn't make it. When he talked to me, it was more, "Do you think you should drop the course? You don't

At three in the morning, it's, "As is, how are you doing? Let's make it through together. You keep me awake, I'll keep you awake." This is a typical attitude that I've experienced several times: This poor guy is working on his project while I'm down in [room] C102. I pull together three of those blue cushiony chairs and make this little instant sofa. Laying down, I say to him, "Can you wake me up in 20 minutes? Please don't forget," and he says, "No problem." I don't even know him or anything; he wakes me up in 20 minutes, and I get up and start working again.

There was one time I was working on my spaceflight project with my lab partner, and I was in the process of flipping between two projects: spaceflight and my airplane. Once I went back to his computer and found him [zonked] out, sleeping. So I tapped him on the shoulder and he made no signs of waking up. I thought, this boy needs to sleep, so I just let him sleep.

There's another funny thing about the E-Quad. You can stand in front of the main door at any time of the night between 12 and six in the morning for not more than 10 minutes and someone passes by. There's always someone there!

Kathy Prestridge '92, Mechanical and Aerospace Engineering

Compared with the A.B. experience, the engineers get to know each other much better because we do so much work together: problem sets sophomore year and then small groups projects junior year. We get to interact and learn to work with people, to see how they work and adjust to that. It's good; sometimes it's difficult, but I think it's important to learn how to do that. I've been lucky that Amy and I have been able to work together and we get along. It's not something that works for everyone, and some people choose to isolate themselves, but I like the social atmosphere.

It is something that you will have to do eventually: work on something and be able to tell other people what you did and have them understand it; produce some end result and produce something with a bunch of other people. You learn how to divide the work up. I think that we have a jump start on other people because we have had experience with group dynamics. We can see, "Oh, that kind of person who wants to do such and such. Let him do that. Let me do my thing, and we'll get together and put it together." A lot of people don't learn how to do that until they get into work and they're forced to do it with a stranger.

Also, I have heard that some people don't know who their advisers are in the liberal arts. I feel that I can walk into my adviser's office, and he knows who I am and what I'm interested in. He has a file on me that he can pull out. In my department I feel comfortable in the area. I can walk down the hall and see my friends who are there. It seems that in a lot of other departments [our size], people don't know who other people are in their department. It's very impersonal.

Engineering has to be close-knit in order to hold you there and make you feel that you're part of the school. If it were very impersonal I probably would have given up. When I was very discouraged sophomore year, I went in to talk to

Professor Curtiss who was very encouraging. He told me that not everyone is a straight-A student, and not everyone who is a good engineer whizzes through Princeton. He really put things into perspective and took the time to talk to me. He realized that I was upset; he wanted to talk to me, make me want to stay in the department. This feeling of belonging goes right down to our departmental mailboxes where they leave us mail, so that we feel that we're part of something.

Nancy Zoeller '92, Chemical Engineering

My RA group freshman year included 25 students, only six of whom were female. One night towards the middle of the year, my RA held a study break. I dropped by a little late and found that none of my roommates (the other five women) had arrived yet. As I approached the door, I heard, "Where are all the girls?" When I entered, another boy said, "All right! An X-chromosome!" In reply, yet another boy said, "Oh, it's just Nancy. She doesn't count; she's an engineer."

The boy who made this comment was in several of my classes. For a while I "punished" him by not studying with him. Finally, I made him apologize, and we continued our habit of studying together (and still do). Most importantly, I never let him forget that I have *two* X-chromosomes.

Jennifer Leslie '93, Mechanical and Aerospace Engineering

One thing I missed out on by switching into engineering was taking first-year courses [with other '93ers]. All the people who were engineers took CIV201, MAE206 or some other lower level engineering course together. They got to know each other and form their network already whereas I entered this year and had to work my way into that.

Physics was the last class in which I really worked with people. I feel that I didn't learn as much [that way]. If I had a question, I'd ask them and vice versa, but if I didn't quite understand the way that they were explaining it, I would just do what they tried to explain to me and say, "Yeah, yeah, I get it." If I asked more questions, they wouldn't want to explain it to me.

Sometimes one guy would plow through homework and every so often, stop and ask me [for help]. Most of the time, he'd need me to help him, but sometimes I would ask him for help. He'd say, "Yeah, here it is; this is how you do it," but if I didn't quite get it, he'd make me feel that if I asked him more questions, I was stupid or something.

Since then, I figured it wasn't worth [the aggravation] because I learn more when I just sit down and do it myself. If I have a problem, I go to the professor or the TA because they're obligated to explain it to me. I've found that [this way] I'm doing better and learning more. I talked to one of my professors about [working alone], and he said that was better because that way I'm really learning; that made me feel good.

I've found professors [to be receptive to women]. My thermodynamics professor would always use inclusive language: he would always say "his or her" and always be very sensitive to both women's issues and environmental issues. Professorwise, I haven't really run into anybody chauvinistic in the classroom.

I think [chauvinism] comes most from fellow students. For example, right around the "Take Back the Night" march, GALAP sponsored the little orange stickers all over the place, and someone had put a bunch of them on the statue right outside the E-Quad. I got into a long conversation about the topic with a classmate.

He kept claiming that they were aesthetically unpleasing and they had no right to be on statues or monuments. I explained that they were just trying to bring up an issue that people were very unwilling to talk about. Later he scraped them off with a knife and some turpentine and came up to me with a "ha!" attitude: "They're off now, we don't have to see them any more and we don't have to deal with them any more." By taking off the stickers, he felt that he was erasing the whole issue, rather than talking about it.

It's hard to deal with [controversial issues] because it seems as though the person is attacking. Even though they don't mean to do so, it can be easily taken that way because things like that mean a lot to me. For example, when they deny things (like saying "there is no discrimination on campus"), I take it as a personal attack because they're devaluing my own experience and saying what I feel is not valid.

I know that there is a huge amount of discrimination and prejudice at the E-Quad as well as all over campus, but I feel that I've never had to go face-to-face with someone who's said, "Look, you're not as smart as I am." There are little incidents like when people don't realize that I'm Hispanic, and they start talking about minorities—how they aren't as smart or it's easier for them to get [into Princeton]. I tell them, look, I'm a minority and I deserve to be here; I'm just as smart as you. That really bothers me, but it's the only thing that I have had to run up against.

I know that a lot of my friends have had worse confrontations. For example, one of my friends was doing poorly in one of her classes and was called in to see deans, but somebody who was doing even worse in that class and failing two others was never called in. I know that goes on, but fortunately, I've never had anything like that happen to me.

I was talking to a friend of mine who is a physics major. She really loves physics, and physics was meant for her, but ever since her first semester here, her adviser's been telling her flat out, "Don't be a physics major; get out of the department." I think that happens in the sciences as well as in engineering, and you could expand [this project] to the other sciences as well and get a lot of information. She told me that she feels very excluded from the Society of Women Engineers and there is no society for women scientists. So she not only feels

excluded from the social aspect but also the support aspect—to explain what's happened to her and to let others know.*

I've worked on the Take Back the Night March and am now on a search committee for the new McCosh Infirmary director. The Women's Center has been a great catalyst to me for getting involved with all of these activities. That's also where I hear different stories about sexist discrimination on campus—like the poster that [a sports] team put up: "Definition of a tiger: a 500 pound pussy that eats you." That is really discriminatory and degrading.

Every time I hear a story like that, my jaw just drops to the ground. I always thought that this is an era where things like that don't happen, but it's not true. It's weird because working with PSAC [Princeton Student Action Coalition] and the Women's Center, I've really learned how the world should be: protecting the environment, creating networks for people who have experienced sexual assault, and trying to decrease the amount of sexual assault and harassment—all this stuff that just seems normal to work on and promote. But I still keep running into people who say that affirmative action is wrong and that only people with 800s on their SATs and 5s on their AP exams are allowed to be here. Well, most of them are white males who have the money to go to private school and their parents pushed them towards going to Princeton. So anyone who hasn't had those opportunities doesn't deserve to be here?

Another thing at the E-Quad, I saw all these posters on how Princeton's sexual harassment procedure is discriminatory against men. I can't remember all the details, but I just couldn't believe it. Don't people realize those policies only exist because men continue to be perpetrators against women? If they weren't, then we wouldn't need those kind of policies at all? We're not discriminating against men, we're just providing women with a means to get justice, too. Things like that happen, and it really bothers me that men really do feel that women are just a bunch of fanatics who are against men.

Whether people realize that or not, it's subconsciously there and [will be] until society is changed and people aren't taught that from the very day that they're born; that's the only way it can change. There's more than just sensitivity that's required; there needs to be re-evaluation of oneself.

One thing that really bothers me too is when someone I really care about uses the word "freshman." I once asked a friend, "Could you please use 'first-year student' even if it's just around me? You're my friend; hopefully you would have some kind of consideration for my feelings." He replied, "No, you're just being really ridiculous." Even though he wasn't calling me anything, it really did offend me.

Some people have asked me which I prefer: Chicano, Latino, or Hispanic. I think it's really nice of them to ask, but for someone to just not care [is disturbing]. It seems to me that lately, people are being forced to re-evaluate a lot of things, right down to what they call people. A lot of them are being forced into

** Editors' note: See historical pieces on SWE in "Women and Engineering" chapter.*

this change, and that's causing a lot of currents of resentment underneath [the surface]. Sure, they'll do it up front and call you first-year student or Hispanic, but there's still a little resentment which is not going to go away for along time. That's what scares me the most. We made some really awesome strides, but now it seems that we are going backward.

Sally Voehl '93, Civil Engineering

I find the professors in the civil engineering department very approachable—Professors Billington, Celia, Donlap. Professor Cakmak I found to be a very nice man, although a lot of people don't think he's very approachable. They seem to really want to encourage you in your field and to make sure you know what you're doing. If you feel overwhelmed by the material, they are there for you to go to for help. It's not cut-throat as it is in some schools like MIT.

I have a friend who goes to MIT. He switched out of engineering because he just couldn't handle the cut throat atmosphere of it. That's one of the best things about Princeton. You can get an engineering degree, but there's more of a camaraderie: the spirit of "Yes, I'm an engineer." I know all my engineering friends and we hang out at the E-Quad together—sick and demented, but much better than cut-throat. Doing problem sets together at 2:00 in the morning, the atmosphere is not "these are my answers and you can't have them," it's "look, let's try to figure this out together and all pass the final."

A support network is necessary because of the difficulty. It brings out the realization that you need to go and ask for some help or find someone else who is going through it, too. If someone else had to stay up till 4:00 in the morning to finish a problem set, it doesn't make you feel stupid. When there's a whole group of you at 4:00 in the morning, then you know it's not just you. It is also going to help in later life because you have to work with people out in the "real world."

Donna Riley '93, Chemical Engineering

I think my experience as an engineer is best exemplified by the 21- foot penis that stands erect at the entrance to the E-Quad. No engineer will deny the phallic implications of the statue, but to have to walk past a looming symbol of male-dominance every day just to get an education is a lot to ask of a woman in such a field. But it is exactly those types of things a woman engineer is asked and forced to withstand as she pursues a career at Princeton.

There was nothing more intimidating than coming from an all-girls high school to a precept for Physics 103 in which there was one other woman out of 20 students. Had my roommate not been an engineer also, I would have dropped it immediately. I felt that somehow I needed to prove that I was competent, and even more competent than the men in my class. I noticed after first semester that many women had dropped physics; it seemed that if a man got a C in physics, he would just hang in there, thinking he needed to work harder, but if a woman got a C, she dropped the course, feeling that she couldn't do it.

Most women don't ask questions in class if they don't understand something, and at first I had no inhibitions about doing so, but I quickly learned that when I asked the question it was "look at the dumb girl, she's wasting our valuable class time." At first I thought I was imagining this type of intimidation until someone in my class said, "Why did you ask that question? That was really stupid. Don't you understand this material? I mean, it's so easy..." Engineering certainly wears down your self-confidence.

Of course, there is chauvinism in engineering. Asking a male friend for help in Chem 205 meant to him that I was coming on to him, but I really just wanted to work on the problem set. I didn't appreciate his condescension, but I put up with it, because trying to convince someone that you are their equal when you've asked them for help is almost impossible, especially given the existing gender dynamics. When I got a better grade than a friend of mine in physics, he got very depressed because he didn't do as well as I had, explaining, "I should have done better than you because, well, you're a girl." Someone whom I considered a friend from my home town discovered that he had gotten a better grade on an organic chemistry test than I. He came up to me in lab, and said, "You went to Westridge, right? That's an all-girls school, right? No wonder I kicked your ass on the chem test."

One of the worst experiences I've had at Princeton in terms of sexism happened in December of 1989. The 14 women engineers in Montreal had recently been murdered, and I was sitting in Frick waiting to take a chemistry exam and talking to some male students around me. One asked me what I thought I was going to major in and I said, "Chemical engineering." To this he replied, "Oh, you're an engineer? Where's my gun?" Everyone laughed, except me. I walked out of the chem exam into Firestone Plaza, where the Women's Center was sponsoring a vigil for the women engineers in Montreal. I shared with these people what had happened to me that evening, and their support made all the difference. Hearing people like Barrie Royce that night was encouraging, because it was the first time I had heard an engineering professor address women's issues within engineering, and his dramatic denunciation of sexism gave me the strength to continue fighting to stay in engineering.

Other professors were also very encouraging of women in engineering, and the gender tension was sometimes broken in amusing ways. I had zoned out of one of Irvin Lustig's CIV 201 lectures on arrays, and I came back into consciousness to hear him explaining this with a "father-son analogy." I heard myself say, "*What??*" just because I hadn't been listening and I couldn't figure out what families had to do with computer programming, but Professor Lustig said, "Oh, sorry. Parent-child." I spoke to him about it afterward, and he said many positive things about women in engineering and apologized again for his sexist remark. I was quite impressed; he was sensitive to something as trivial as classroom language and this was greatly significant.

Maitland Jones has also been important in encouraging my progress in

chemical engineering by being outraged at the small number of women professors in the sciences at Princeton, and by recognizing the need for our society to be restructured if women are ever to gain an equal position in the work force or in academia. The professors' confidence in women has counterbalanced, to some extent, the negative attitudes of my peers.

A very negative aspect of being an engineer at Princeton is the competition which is intensified for women in different ways. People looking into others' [department] mailboxes to find out how they did on a test is academically unethical and very intimidating, but it unfortunately occurs, at least in the class of 1993. Competition is even worse for women because of the need to prove ourselves in a male-dominated field, and because we tend to compete amongst ourselves, because perhaps we let ourselves believe it is all right after all if men do better than us. Sometimes the competition draws us together and we can work together and in that way support each other as engineers. In fact, most women I know work in all-women groups on problem sets, and I think this has evolved since our first year by trial and error. As engineers, we women have learned to stick together and work with each other; this is one of the few "female bonding" experiences Princeton has to offer and is a key to survival.

I wish SWE could work with the Women's Center; because SWE is so career-oriented, it offers little to underclass women, especially in terms of keeping them from being discouraged. It seems to be a somewhat silenced voice, and I wish they would make themselves more visible and be more supportive of women in an active way. I'm not sure what form this should take, but why wasn't SWE around at the time of the Montreal Massacre? I felt sympathy from other women, and from other professors, but no sense of empathy. There was no one to share the grief that I felt as a victim of the same type of sexism that caused someone to murder these women simply because they were women and engineers. Some people said it was just a nut who blew away women to be violent and what a shame it was. My question is what kind of a society do we live in that would produce such a pathological misogynist? One that would say, "You're women. You're engineers. You're all a bunch of feminists. I hate feminists." Why wasn't SWE there? Did no other women engineers identify with me or my experience, or with the women at Montreal? Where is the voice of the woman engineer?

Another factor influencing the gender tension within engineering is the stigma of the typical engineer. We all know this: "to hell with football, we want sex," right? Men in engineering expect to have a difficult time with women and tend to ignore our social side. We're great to work with in lab, especially when we understand things that they have trouble with, but outside of the classroom we disappear. If they do happen to notice us outside of the classroom, it is usually in an objectifying way; as engineers they have to treat women like meat in order to fulfill the stereotypical image. I'm not saying that all men are like this, and I have very close male friends in engineering (even though few of them treat me as an equal), but the stereotype is out there in the back of everyone's mind whether we

choose to act accordingly or not, and it does take its toll on our relationships.

I once read in the book *Women Reflect About Princeton* an alumna's opinion that when a woman is west of Washington Road, she is respected for who she is, but when she ventures east of Washington Road (for example, Prospect Street), she runs into all the sexist attitudes and associated problems. I would just like to point out that the E-Quad is also east of Washington Road, and I don't think this fact invalidates her statement.

I've rambled on for quite a while now, and I think it's time I stopped. It takes balls to be an engineer at Princeton. For men, that means resembling the statue in front of the E-Quad, but for women, that means having courage to be who you are and having confidence in your abilities and in your equality with men. It means standing up for yourself amidst adverse circumstances of sexism and self-doubt, and challenging all the pre-conceived notions about gender roles in our society. Being an engineer is inherently going against the grain of society's ideals for women, and is therefore inherently feminist. This is what being an engineer at Princeton means to me (especially in light of the optimistic statistics of the ratio in Intro to ChemE : 56F-44M). Thank you for giving me a voice.

Experience is what survives when what is learnt is forgotten.

— B. F. Skinner

Women and Engineering

Whether women are better than men I cannot say—but I can say they are certainly no worse.

—Golda Meir

SO, WHAT IS THERE TO SAY, SPECIFICALLY, ABOUT WOMEN AND ENGINEERING? ALTHOUGH THE EVALUATION OF ENGINEERING, SPECIFICALLY AT PRINCETON IS THE MEAT OF THIS BOOK, WE CHOSE TO EMPHASIZE WOMEN ENGINEERS. IS IT RIGHT TO CONSIDER THEM UNDER A SEPARATE TITLE? FURTHERMORE, BY DOING SO, DOES THIS IMPLY THAT WOMEN ENGINEERS ARE A BREED UNTO THEMSELVES—DIFFERENT FROM MALE ENGINEERS AND OTHER WOMEN?

IN PARTICULAR, WHY DO FEWER WOMEN STUDY ENGINEERING THAN OTHER FIELDS—EVEN OTHER "MALE-DOMINATED" FIELDS SUCH AS SCIENCE, LAW, AND BUSINESS? WHAT IS DISTINCT ABOUT ENGINEERING EDUCATION AND THE ENGINEERING ENVIRONMENT? HOW DO PEOPLE, BOTH IN AND OUT OF ENGINEERING, PERCEIVE THE ROLE OF WOMEN IN THE FIELD? WHAT INFLUENCE DOES THE PRINCETON ENVIRONMENT HAVE ON THE STUDY OF ENGINEERING, SPECIFICALLY WITH RESPECT TO WOMEN STUDENTS? THE PRECEDING CHAPTERS HAVE ATTEMPTED TO SHED LIGHT ON THESE QUESTIONS.

ASIDE FROM THESE PROBING QUESTIONS, WE WERE ALSO CURIOUS ABOUT WHAT WOMEN ENGINEERS THINK ABOUT THE DIFFICULTIES OF BALANCING FAMILY, CAREER, AND PERSONAL FULFILLMENT. IN THIS CHAPTER, THESE WOMEN, DIRECTLY AND INDIRECTLY, QUESTION THE TRADITIONAL STANDARDS OF WORKING 110 PERCENT OF THE TIME TO EARN JOB TENURE, THE (UNCONSCIOUS?) DOUBLE STANDARD OF PERFORMANCE EVALUATION, AND THE FACT THAT, BY VIRTUE OF THEIR SHEER SMALL NUMBERS, THEY HAVE BEEN AUTOMATICALLY ELECTED REPRESENTATIVES OF THEIR SEX.

The Published Record . . .

From "Are Princeton's Women Afraid of Economics?" *Princeton Alumni Weekly,* May 8, 1973, p. 12–13

Not long ago, Assistant Professor of Economics Uwe E. Reinhardt telephoned the *Daily Princetonian* office to ask why an official notice he submitted had not appeared in print. "ECON 207—Open to all women students," the notice was to have said.

"But all courses in the university are open to women," replied the puzzled *Prince* reporter who answered the telephone.

"Yes," agreed Reinhardt, "but the women don't seem to know that." In the past three years of coeducation, he said, there had never been more than one woman in this undergraduate course. Again this year the male-female ratio in "Development and Use of Accounting Data," remained 90 to 1, since the *Prince* had lost Reinhardt's notice and unintentionally blocked his one attempt to ameliorate the situation.

Unfortunately, professors agree, Reinhardt's is not the only course that Princeton undergraduate women avoid. No women in the Class of 1973 are majoring in economics, physics, astrophysics, or chemistry: only one intrepid female elected to enter the engineering school. In contrast, 17 percent of senior women are English majors, with 14 percent in history, and 10 percent in art and archaeology. These statistics should surprise no one at Princeton, since former Professor Gardner Patterson's report on "The Education of Women at Princeton" predicted accurately in 1968 that women, if admitted, would flock virtually *en masse* to the humanities. Still, faculty members and administrators are concerned that women are not making full use of the resources of the University and that, consequently, the range of career opportunities open to them is limited.

"I know the courses I teach are basically dry stuff," Reinhardt acknowledges, "but the students who take them are interested in decision-making. They will become top lawyers and economists." Reinhardt fears that Princeton women are refusing to elect the courses in corporate finance that could prepare them for positions of authority on Wall Street or in Washington.

Robert G. Jahn, Dean of the Engineering School, is also disturbed by the small number of Princeton women entering his field. "There's an archaic image of an engineer as someone with a hard hat and a greasy hand doing fairly menial tasks—building dams, drilling oil wells," Jahn says. "But that's simply not true for the bulk of engineering professionals. Besides, the job market for female engineering graduates is fantastic. We literally get calls twice a week begging for them." For reasons unknown to him, Jahn says helplessly, "there are an agonizing number of women good in math and science, who like to solve problems, to whom it would never occur to go into engineering."

This brings us, of course, to the question of why Princeton's intelligent, informed, hand-picked female population chooses so uniformly to enter human-

istic fields. Certainly few persons, especially Princeton women themselves, would be likely to suggest that they lack the intellect for rigorous scientific or other quantitative work. Standards of admission for women thus far have been, if anything, tougher than those for men. And if there does exist, as at least one professor privately speculates, the possibility that "on the highest levels of abstract thinking women just don't have it," such an intellectual limit would hardly disqualify women from any undergraduate course taught here.

The argument that most Princeton women, like other American females, have been conditioned by their culture into believing that some fields are more properly feminine than others is more convincing.

"In our society, we've associated technology with masculinity," points out Assistant Professor of English Ann Wood. "Women want fields that will be an extension of their image. It's more congruous for a woman to read poetry or look at paintings than to spend her afternoons in a laboratory welding steel."

High intelligence does not exempt women from having their interests and even their aptitudes molded by current cultural attitudes toward femininity, professors agree. Observes Professor of Sociology Marvin Bressler, "There's no reason to assume that in the short run brightness alone can overcome culture patterns as profound and enduring as female socialization." Besides, Bressler says, there may be telling practical reasons why women elect the majors they do. For the woman who views college as career preparation for marriage, community service, and gracious living, English or art history is clearly the thing to take.

Certainly it is possible that having the "graceful exit" of marriage as an option makes Princeton women less prone to elect grueling major subjects. No man can yet predict what Princeton alumnae will be doing 10 years from today. Still, it is safe to say that a large percentage of coeds are competitive and career-oriented—at least for now. This observation leads some professors to speculate that other factors most closely linked to the university are steering women away from certain fields. Assistant Professor of Politics Kathryn D. Boals reports that students in her course, "The Politics of Male-Female Relations," interviewed three professors in each of 15 departments and found the most negative attitudes toward coeducation in physics, engineering, and the Woodrow Wilson School of Public and International Affairs. "This suggests a systematic effect rather than women making free choices," Boals concludes.

Discouragement of women from within the University becomes more plausible when it is taken into account that the largest percentage of entering freshman women in recent years have indicated they planned to major in biology and mathematics. Clearly something happens to these girls along the way to make them change their minds. Some of them are undoubtedly deterred by finding their proposed majors more difficult than they had thought. Still, says Professor of Sociology Suzanne Keller, "I'll bet a lot of technical fields in this country make women feel inadequate. And if you don't feel welcome or confident, you get out."

A panel of women students speaking recently on Freshman Parents Day indicated a feeling that no single department is more hostile to women than any other but that individual professors are sometimes inhospitable. And even when a department is openly friendly to women students, its good intentions may be thwarted. The engineering school boasts a sophisticated and energetic campaign to attract females to its premises; however, junior Patricia A. Kuntz, now in aerospace and mechanical sciences, recalls that when she applied to Princeton, pressure was exerted to persuade her to switch to the A.B. degree. Kuntz says she tried but has been unable to determine whether the pressure came from the engineering school, the admissions office, or her alumni representative.

Some professors suggest that the dryness of many quantitative courses at Princeton may repel women. Ambitious male students suffer through unpleasant courses on the way to money-making careers; women are more apt to be lured by the aesthetic gratification of hearing Daniel Seltzer lecture on Shakespeare, or Thomas Sloan on Impressionism. To attract women to courses in economics or engineering, Kay Boals says, "The subject matter would perhaps have to be taught in a way connected to human needs, emotions, and thoughts. Now it's dehumanized."

Interestingly, the percentages of women that major in economics at Smith and Wellesley are comparable to the percentage of men that do so at Princeton, suggesting that economics is not an inherently "masculine" field. Also, it may be that because of the still impressive, overall "maleness" of Princeton as an institution, women tend to be easily intimidated by some departments. Associate Professor of Physics David T. Wilkinson points out that many more women major in physics at large state universities where the atmosphere is impersonal and they feel less pressure to succeed. "Physics is terrifying here," Wilkinson notes. "The women are already off-balance because of their small numbers and the newness of coeducation. To expect them to pick the hardest department is unreasonable."

Whatever the reasons offered why women select some fields over others, in any discussion of feminine behavior it is important to consider how men think and act in the same circumstances. If most Princeton men majored in physics or economics, the seeming aversion of their female counterparts to those subjects would be indeed a phenomenon. But the largest percentages of Princeton men major in history and English, like the women. Since it is highly unlikely that the "quantitative" departments are out to discourage both male and female students, the reason for the attraction of these fields must lie elsewhere. Cynics might speculate that the average student simply finds it easier to appear knowledgeable in a precept on the Civil War or *Huckleberry Finn* than in a thermodynamics lab.

However, in all fairness to up-and-coming generations of Princeton women, it must be noted that they are beginning to infiltrate the most solidly male departments. This year six women are majoring in economics, and 19 (including freshmen) have entered the engineering school. These numbers can only be expected to increase with time. As engineering's Dean Jahn puts it, "Right now it

takes a certain amount of courage and breaking with tradition for a girl to be an engineer. Ten years from now that courage won't be necessary."

From Princeton University Press Release, April 13, 1973

The Society of Women Engineers, a national organization with an international membership of some 1,200 professional women engineers, has a new chapter on the Princeton University campus. A student section has been formed by 11 of the 17 women studying in Princeton's School of Engineering and Applied Science. Two other women science students are also members.

Goals of the student section include: listing summer jobs for women studying engineering, maintaining liaison with and providing information for high school guidance personnel in the area, visiting area research facilities, and providing general support services for the expanding number of women who will be studying engineering, science, and mathematics.

. . . What emerges from conversations with some of the student members of the Society of Women Engineers is a seriousness about their work and no apprehensions about their futures in a profession where they will be outnumbered 100 to 1 by the opposite sex.

Donna L. Kasbohm '76 has always been interested in mathematics and science. Given her interests and an engineer father who encouraged her, engineering seems natural to her. She'll be majoring in chemical engineering because she's interested in waste disposal and treatment. Asked about the preponderance of men in her new environment, she replies, "I don't really notice it until I look around."

Katherine E. Meyers, who switched to aerospace and mechanical sciences from mathematics, plans graduate school and a teaching career. She says, "The only time it really got to me was in freshman physics. I watched 150 people come through the door and all of them were men."

For freshman Claire M. Shortall, there had never been any contest. Her scores in the mathematics and physics sections of the Student Achievement Tests were some 200 points higher than her other scores. She has wanted to be an engineer since her sophomore year in high school and resisted, unsuccessfully at times, being placed in high school courses like home economics and sewing in lieu of mechanical arts and drafting.

Debra A. Meloy '75, an astrophysics major (membership in the Society of Women Engineers is open to all women scientists as well as to women in architecture, mathematics, and statistics) worked last summer at the U.S. Naval Research Laboratory in Washington, D.C., and detected no sex bias in her coworkers. "They're great over there," she says, "really friendly!"

While the women report no discrimination from male students and faculty, and while they anticipate none from future employers and colleagues, some have encountered entrenched traditional attitudes within their own families. When

one woman expressed her desire to become an engineer, she was advised by her mother to become a secretary and seek employment in an engineering firm.

Another student's aunt responded with: "Some young man will come along and change your plans." One student says that her parents felt that she should not go to college because "women don't go to college," and another reports: "My mother thought that Princeton was above me." A few students maintain that such attitudes were reinforced by high school guidance counselors.

By contrast, Nancy N. Munnerlyn '76, chairwoman of the Princeton student section of SWE, received support and encouragement from her family. "My mother's mind was on college from the time we were in kindergarten," she says. Miss Munnerlyn is also black and although the magazine, *New Engineer*, has pointed out that there are as few black engineers as women, she is optimistic about her professional future.

From "Women in Engineering: in the U.S. and at Princeton," *University: A Princeton Quarterly*, Spring 1976, p. 18–20

To get a more detailed profile of the woman engineer, where her interests lie, and how her work fits into her life, I spoke to four such women who teach or do research at Princeton. My first impression was that they were too attractive, simply too pretty to be engineers. (Intellectually I had risen above the stereotype, but emotionally I still expected a masculine creature with a slide-rule strapped to her waist, leather skin, hard-hat, and a soul to match. I was, of course, completely wrong.)

Dr. Margaret Fels, charming, slender, and energetic, has two children, a boy and a girl, aged two and four. As I sat on the couch in her living-room during one of the afternoons when she wasn't teaching (she is on a six-tenths schedule), I watched her young daughter sitting at her feet and I wondered aloud what a woman engineer would give her children to play with. Nuts and bolts and Erector sets? Surely she would not make the usual mistake of blocks for boys and dolls for girls? "I do give my girl dolls," she said laughing, "and my boy plays with them, too. It's a good way to work out problems." Far from seeing her children as keeping her from work she'd rather be doing, Fels enjoys being with them. She credits her husband's help (he's also a scientist) with making the arrangement work. "It would be impossible for me if he didn't encourage me to have a career, or if he didn't help care for the kids." She also has a dependable baby-sitter two or three days a week.

. . . Another member of the faculty who contradicts one's expectations of the female engineer is Dr. Lynne Holt, an assistant professor of civil engineering. Tall, with huge brown eyes, an engaging smile and a surfeit of talent, Holt is interested in systems engineering. But this wasn't always on her mind. She was a math major in school. Her father, now deceased, was chief engineer at steel corporations and founded his own consulting firm. Despite this background, Holt studied to become a concert pianist. At one time she was also an equestrienne and taught English equitation. At another time she was a scuba diving instructor. But she found math challenging and intriguing and enjoyed the

problem-solving. Perhaps it was wishing to follow in her father's footsteps (as sons often did), but she finally settled on engineering as a career and worked for Bell Laboratories in developing the picture telephone.

. . . Dr. Josette Bellan was Princeton's first woman graduate student in aerospace and mechanical engineering, and is now on its research staff. She is French, married to a Canadian, and has a twin sister who also has a Ph.D. in aerospace engineering. Bellan specializes in the study of combustion and is interested in everything from the propulsion of rockets to the burning of forest fires and cigarettes.

Referring to her educational experience in France, Bellan says there is greater freedom there for women to enter fields such as engineering, perhaps because Americans have been more affluent. For generations, most educated women have not had to think of careers as necessary to add to family income. In France, more women have had to work, and although Bellan says finding a woman engineer may be unusual, it is not as rare as here.

She thinks that in this country a woman engineer is looked upon as "an interesting specimen" because we still believe that a woman's work should be different from a man's. "But," says Bellan, "why shouldn't women enjoy engineering? I'm really interested. I get a great deal of pleasure from my work."

Dr. Nora Sabadell, a lecturer and member of the research staff in chemical engineering, who is from Argentina, agrees. She has seen many more women in fields such as math and engineering in foreign countries than here. She acknowledges "an enormous increase in women in science and engineering here, but when you begin from almost zero, any increase is enormous."

This charming woman who answers the phone with an efficient (some would say masculine) "Sabadell!" got into chemistry and engineering because she was good in math and science in high school. She now is involved in research on water purification....

Men and women engineers are pretty much the same, Sabadell believes, but the apologetic approach to success some women took in the past is fading away, especially with the new crop of women students. She does admit that until the last few years women were a rarity at the engineering professional meetings, but now men are getting used to them and "don't bat an eye."

Sabadell is married to an engineer and they have three children who, she says, are very proud of her. "I can bring into the home many interesting topics and experiences because I have to be aware of what's going on. My work is an asset for my family."

She also believes that this country, by not taking full advantage of its young women's talents, has wasted a lot of intellectual potential. "We have to wash away all the preconceived ideas that because of gender one cannot do one thing or another. Your profession has nothing to with your femininity, your family situation, or anything else, but with your capability to do a good job at it."

Our educational system seems to her a bit antiquated. She says that universities are changing, but elementary and secondary schools in most places have not changed. And that's where the effort has to be made. "Why does a man have to be the breadwinner?" Sabadell asked, a long silver ring glinting on her finger, eyes smiling at me. "If he wants to stay home and write or take care of the children, he should. Or if a woman wants to stay home and spend all her energies there, she should. But if she wants to be an engineer, why not?"

Indeed, why not?

From "A Personal View of the Society of Women Engineers Convention," *Princeton Engineer*, October 1978, p. 4

My discussions with working women were the most important aspect of the conference for me. Each managed in a slightly different way, but they all were obviously thriving on the challenge of an engineering career.

One woman I talked to en route to the restroom told me to work for the government. "You don't make as much money, but you are promoted faster," she said. She was with the Nuclear Regulatory Agency.

An electrical engineer I met showed me a printed circuit board that she had just spent six months developing. It was a memory device that could simultaneously read and list data. When I asked her about how she arranged her private life, she told me with equal enthusiasm about her two sons, their interests, and accomplishments. She felt it was working out very well for all of them.

I left the conference having seen my dream a reality in all these women's lives. No longer is an engineering career something elusive and rare for women. I now know personally that women are competing and being promoted and loving it. I can't wait to join their ranks and return to inspire more women. Women have done it. We can and will do it.

From "Being a Woman Engineer: Is it Worth it?" *Princeton Engineer*, December 1979, p. 10–11

The motivations of my companions [for attending the Society of Women Engineers national convention] coincided with my own, but I was also seeking the answers to some deeper questions. I was, and still am, going through one of my periodic "What the *hell* am I doing in engineering?" crises. I was hoping that the conference would provide me with some new insights. . . .

Other things disturbed me, too. One girl from a small college in New England told a group of us, "The guys really have trouble accepting me. Like, we had this test and just about everyone failed and I got an A. And this guy said to me, 'Wow, I should take lessons from you!' So, I said, 'Listen, any time you need help, I'd be glad to go over the problems with you.' He cut me short by saying, 'I don't need help from a girl.'" Her story surprised me. I wondered if the reason that I had never experienced such hostility at Princeton was that I had generally been the one asking for, rather than offering, assistance. . . .

My enthusiasm was slightly dampened, however, at a seminar entitled "What is SWE?" To the professional women engineers who led the panel discussion, SWE was a means of making contacts within the profession because "men will not be your contacts." We rather impressionable young women were told that we would be excluded from the information network that men set up among their "pals" in the office and thus we would not be privy to the bulk of information that helped one climb the corporate ladder. The essence of the leaders' message: "You're on your own, honey, and you better sharpen your claws for battle."

One woman related to us how she had asserted her authority over a male underling by getting him into trouble with her boss. I was upset not by the fact that she had put a man in his place, but rather by her pride in this petty victory over another human being. I find the idea of climbing the corporate ladder by brown-nosing and back-biting rather distasteful at best, for either men or women.

It seemed to me that these women were not taking advantage of this age of, at least slightly, less rigidly defined sex roles. Instead of exploring the merits of traditionally male definitions of getting ahead, they were saying, as many feminists do, that men have it better and the only way to even things out is act like men. I feel that there is something fundamentally wrong with this approach. Rather than completely "deprogramming" ourselves and trying to emulate men, should we not be reexamining traditionally masculine as well as traditionally feminine values? Much of what little girls are taught tends to narrow their capabilities in male-oriented arenas. But I think that it is important to realize that by merely adopting "masculine" attitudes, women are trading one set of limitations for another.

Fortunately, the "What is SWE?" program did not set the tone for the convention. The advice offered about such practical matters as dating within an office was beneficial because young women simply do not have the abundance of role models in the business world that young men do. The Society of Women Engineers provides a needed forum for the discussion of such needed reforms as parental leave and flexible working hours. I am optimistic about what the professional world can become if men and women work together for sexual equality.

From "Princeton Represented at National SWE," *Princeton Engineer*, October 1984, p. 18

Is the Society of Women Engineers a feminist organization? No, it is a professional organization, like AIChE, IDDD, or AIAA. The objectives of SWE are:

- to inform young women, their parents, counselors, and the general public about the qualifications and achievements of women engineers and about available opportunities
- to assist women engineers in preparing themselves for a return to active work after temporary retirement
- to serve as a center of information on women in engineering

- to encourage women engineers to attain high levels of education and professional achievement.

SWE welcomes any man or woman who believes in our goals and is concerned about the problems a woman may face in a male-dominated field. Men can benefit as much as women from most of the activities we sponsor, such as plant tours and word processing seminars. On the national level, several men hold very important positions.

. . . Personal Voices

Patricia Kuntz Falcone '74, Aerospace and Mechanical Sciences (now Mechanical and Aerospace Engineering)

I was on campus during those heady early years of coeducation. It was fun and fulfilling to be the first anything; it wasn't clear what we would all do but at least there weren't models of Princeton women graduates who had "wasted" their education by not using it professionally. We, of course, would be different. Further, we had a responsibility to future Princeton women to be different—to accomplish real things. (It was encouraging to begin reading Stanford literature and seeing notices of women graduates out as long as the men.) Our smugness seems to have been characteristic of the age. It is, of course, harder to do everything than we imagined: to have a fulfilling career and in addition, to have a stable marriage and to raise children.

Here are the real challenges. I feel I have been lucky but how do you balance two "perfect careers"? You can't over- constrain the problem. Roger (my husband) and I are fortunate that graduate school and jobs have worked out well. We do commute from our home so we are not as available to our children as I would like to be in the event of an emergency or just dropping in. I took off about three months when my daughter was born, and returned to work full-time. I stayed off work for nine months when my son was born, and returned to work last October on a three-quarter time schedule. Now I find myself juggling work with volunteering in my daughter's classroom and co-leading a Brownie troop. I try to keep my colleagues up-to-date on these latter activities to raise their consciousness. Fortunately, my employer got around to devising a part-time employment program just after my son was born. Now, I feel it is important to exercise the policy.

Keeping up with other women in the sense of keeping in touch has always been and continues to be important to me. I'm not big on women's organizations but rather prefer an informal network which includes occasional lunches and more generally just talking. An important treat has been keeping up with women from Princeton. It is wonderful to have the continuity of these friendships.

Life as a professional engineer is easier than it was to be an engineering student for two reasons. One is that I have good credentials now and can't really

be challenged on "do you really think you can be, or want to be, an engineer?"—questions that were more unsettling when I wondered whether or not I could make it. The second reason is probably part of the first, a greater self-confidence on my part. It took a long time for me to understand that people look to you for cues, and if you act confident, they will presume you to be competent.

Claire M. Shortall '76, Chemical Engineering

Over the past five years, I've noticed a considerable number of women engineers my age leaving the work force. Biological clocks are ticking, but that's not the entire reason. The "glass ceiling" is all too real. The subtle forms of discrimination are alive and well. "Enough is enough," they have declared, as they've turned full-time efforts to their families and other interests. Are the Princeton women any different? Somehow I don't think so, but I haven't asked my two classmates who listed "wife & mother" and "extended leave" in the 15th reunion directory to elaborate their reasons.

I'm the only woman engineer from my class who has never married. I don't know if I ever will, but I highly doubt it. I just enjoy my complete freedom and independence too much. Fortunately, my dog is a "happy camper." He is boarded so frequently that he has his own "suite" at the vets, and the staff there spoils him rotten!

I was active in SWE as an undergraduate and have remained involved with the organization ever since. As president of the student section, I was fortunate to attend my first national student conference and convention in June 1974 in Dallas. It was the most exhilarating experience, and I still keep in contact with many women I first met there.

Since 1974, I've only missed two national SWE conventions. I organized two sections in Louisiana while living in Baton Rouge and New Orleans. I served as the provisional director for the Gulf Coast Region during SWE's transition to a regional structure. I spent three years as national treasurer and am now a member of the board of trustees. (I've been told I'm the youngest trustee ever elected.)

I am the first to admit that SWE is not what I want it to be. There's so much to do and resources are always a problem. Nevertheless, many of SWE's local career guidance efforts are excellent, and the organization serves an important role in this area. As a result of my extensive involvement in SWE, I have a network of contacts in all parts of the country. Some of these women are my closest friends. In many ways, I wish more Princeton graduates were members of SWE. It's an organization which I believe all women engineers should support via membership even if they do not participate in any activities.

Even though I haven't worked as a engineer since 1979, my engineering degree certainly helped to open the right doors so I could parlay my skills into other areas. I believe engineering is a viable career opportunity for women and that, as women engineering graduates, we have a moral obligation to encourage

young women to consider engineering as a career, to encourage and recognize women engineers, and to raise the awareness of others concerning women in the engineering profession. Those are SWE's objectives.

I am committed to SWE and have belonged to several all-women groups (Business and Professional Women's Clubs in Baton Rouge and New Orleans, Women Professionals in Petroleum in New Orleans, and Zonta International in Houston). At Princeton, however, I only entered the Women's Center to attend one open house. Several crew teammates were there, including the other woman engineer on the team, so I knew a few people. I never went back because I was so disgusted with the male-bashing tone of everyone else I spoke with that evening. It didn't seem to be called for and certainly didn't seem constructive to me.

True, there weren't many women engineering students at Princeton when I was there. There were even fewer blacks. (One black woman started in my freshman class but withdrew after the first semester of sophomore year. Nancy was the first president of the SWE student section. I ran into her several years later at a SWE convention; she was a student then at Case Western Reserve, but I am not sure if she ever completed her engineering degree.) I guess one thing I noticed at Princeton was that the women and black engineers always acknowledged each other on campus even though, in general, the campus was quite segregated socially. There was a bond by virtue of our choice of majors. (Now that I'm writing this, I can't recall any Hispanic engineering students in my class.)

Connie Crawford '78, GS, Civil Engineering

The only significance of being a woman engineer that I can identify is that it helped me get into Princeton. Otherwise, I'd say being a woman had no measurable impact on my engineering education.

I have been working as an engineer designing bridges for over 10 years. In my view, engineering is a good field for women because it is objective. If your calculations are orderly and correct, and if you are good at solving problems, you will [be] desirable to an engineering firm. This works equally well for men. However, I have noticed that a woman who is only average in ability may be viewed as slightly less capable than an average man. Anyone coming out of Princeton would not be classified as average in any engineering firm I know of. I stayed at Princeton for my M.S.E. after the B.S.E. I thought women got fair and equal treatment at both levels.

From Sandra Hull Seale '81, Civil Engineering

I was born in Princeton. My maternal grandfather, James L. Green was a professor at Princeton in the Department of Civil Engineering. My father, Frederick H. Hull '60, was a graduate of his. I grew up familiar with the town and the campus; we lived in Pennsylvania and visited my grandparents frequently. Princeton always had a strong attraction for me.

When I was a senior in high school, my father had plans for me. He wanted

me to attend one of the Seven Sisters schools. He took me to New England to interview at Smith, Mount Holyoke, and Vassar. I had plans of my own. I was an excellent student and very good at mathematics. I wanted to study engineering at Princeton. When I told my father that I was interested in Princeton, he became angry. He told me that he knew what Princeton was like. It was no place for a woman, and I would be a freak. For two weeks we did not discuss Princeton.

My mother encouraged me to send for an application. The thaw began after the application arrived. My father said that he would arrange the interview and take me to Princeton for a day. He may have visited the campus or spoken with some of his friends who were teaching there. I don't know what happened, but he changed his mind about my going. I applied as an Early Action candidate and was admitted before Christmas.

As a faculty member, my grandfather was very concerned about the changes that having women on campus would bring. He disapproved of what he called the "experiment of coeducation." After eight years of debate, his personal feelings for me decided the issue. Once I matriculated, my grandfather changed his mind forever about coeducation.

In my freshman year at Princeton, I had a bad case of "Public School Syndrome." Since I had rarely even opened a textbook in high school, I had no idea of how to study. The shock of Physics 103 forced me to learn how to learn. After a rocky first semester, my grades were excellent. In my senior year, I decided to apply to graduate schools in civil engineering. For the location, the reputation and the financial aid, I chose MIT.

At MIT, I had my first (and only) experiences with sexism. I was the first Ph.D. candidate with U.S. citizenship in my division in several years. I was the first woman candidate in more than a decade, and probably the second one ever. (These facts were difficult to uncover; no one would talk to me about it.) On my first day at MIT, I had an appointment with my academic adviser, a crusty old-time engineer. As he reached to shake my hand, he said, "I hope you do better than the last woman we had from Princeton." This woman, who was whispered about in the hallways, had left the previous year without finishing her master's degree. I was truly an alien in this place: not only a woman, but a Princeton woman.

One faculty member was particularly obnoxious. He would walk up to me and say, "How's our Princeton girl today?" I never answered. Once, when the department was undergoing a brief self-examination, he chased me down the hall to ask if I had ever experienced any sexism at MIT. My answer was, "You wouldn't believe the things that people say to me."

My thesis adviser had his own blind spots. When I told him that I was going to be married, he said, "But who will I get to replace you?"

Over the years, the chairman of the department had kept up a dialogue with me about whether or not I would want to stay on and teach. In my last year as a graduate student, I told him that having a family would be a priority to me. His

response was, "If you're not a team player, you can't be on the team." This attitude prevails. The only two tenured women faculty members in the department are single and childless.

While I was a graduate student at MIT, Barbara Aronstein Black was appointed dean of Columbia Law School. I have kept the newspaper article announcing her appointment, which contains a wonderful quote by her:

> The message is not merely that a woman was appointed dean at Columbia Law School, but a woman who did what I did: who took on the traditional duties and obligations and joys of the woman's role, who traveled a terribly circuitous path back to the job that she had always wanted, whose work was not of the quantity that the more direct male path would have produced.
>
> What it suggests is that this kind of life experience is relevant to the professional world, perhaps even important, perhaps even critical. I really do believe that where I am today has every thing to do with the years that I spent hanging on to a career by my fingernails.

Professor Black was speaking of her law career, but these words apply equally well to engineering. I am currently in the "fingernail" stage of my career. I work hard to keep my name in the academic journals and to attend scientific conferences. The quantity of my work is low, as I spend half of my time with my small children. I hope someday to return to full-time academia and to find the job that I have always wanted.

Jennifer Bonini '91, Civil Engineering/Geological Engineering

I can't ignore that fact that I'm a woman in science. I have an older sister who's a post doc at Cal Tech and I know that she's one of the few female post docs in the lab. Her being in science academia—a very male sphere—has made me more aware of these issues. Certainly having a roommate who is interested in women's studies has also had an influence. I like to think of myself as an engineer, period, and that I'm as capable as any other engineer, whether I'm male or female. But, the way you develop socially is a very important thing in terms of self-confidence.

Guys generally have the ability to keep going and not think about how rough or tough things are. They've got this inbred self-confidence, and it's partly from the way they've been brought up from day one. There are a lot of things that are a part of you because of the way you develop socially. You may want to think that things are far more equal, but I definitely think there are things that develop in each person from each experience.

Every female is not going to be the same, just the way every male is not going to be the same. While you cannot make broad men-women generalizations, I do think you have to be aware of it. My experience as an engineer was different for a number of reasons—because of the program I was in, because I was female, because of where I lived, because of whom the Housing Department put with me as roommates. All those things factor in, and I would definitely say that being a woman in engineering was one.

I was elated the first time I had a female professor, although it wasn't in engineering. I would have loved to have a female professor in an engineering course, just because of the different perspective, and I think that kind of situation would be neat for guys, too, because it would be different even for them. You're just accustomed to having this male influence. By entering your experience through your course of study, professors make you think about different things.

One of the things I liked about geology was when I did independent work. I had a woman adviser and it was awesome to have a role model—someone who had been through a program and had these experiences as a female—someone I could relate to a little more. I've been in the male sphere my whole life and am certainly used to it, but this change was very nice.

It wasn't that I'd "prefer a woman over a man." Rather, I'd prefer a woman over a man if I've had twenty million men and I've never had a woman. That's where it makes a difference to me. I want to choose the best scientist to work with, but I also think that the experience of working with a female scientist was an important educational experience for me.

Anat Shiloach '91, Chemical Engineering

Since second semester of sophomore year my engineering experience has been defined by the department. It differs from other departments in that it requires a set of core courses that must be taken in a unique sequence over six semesters. During each of those semesters I had at least one, if not two or three, classes with the same 20 people. The first class provides a gentle get-your-feet-wet acquaintance with Chem E, but the second is already difficult enough to require group attacks on problem sets. The classes get harder from there. I got to know those 20 other people; we all got to know each other. Some nights there would be 10 of us working together on a problem set in the undergraduate lounge. People were always willing to share their methods and their answers. I felt much more cooperation than competition among us.

I'm not quite sure what contributes to this cohesiveness. The structure of the major most certainly encourages it—it's hard to take that many classes with the same people and not get to know them—but it's not everything. Partly we just may be, by chance, a friendly bunch of people. And partly it may be our ratio: 12 men and 9 women. I won't contribute to the debate of why so many more women enter chemical and civil engineering as opposed to electrical and mechanical; and I won't say definitively that the ratio influenced our ability to work together. But it may have. Maybe there were conflicts I didn't see and tensions I didn't notice. I was too busy enjoying the support of a group of people facing similar challenges.

Often I've thought that perhaps I've just been lucky. I've heard so many stories from so many women about guys who argue over any answer, who refuse to accept anybody else's reasoning, and are reluctant even to explain their own. I haven't had those experiences. With the exception of one semester of core lab, I've always been able to choose the people I work with. One semester of lab I

worked with two women. We got along incredibly well, but we were friends beforehand. Another semester I worked with two guys. We had a few problems, but we also weren't close friends before the lab. I don't think any of the problems were gender-specific.

I'm optimistic [about the real world]. I'm not a feminist and I'm not an anti-feminist (non-feminist?). In fact, I don't think much about these issues at all. I'm idealistic: I expect that in the real world prejudices about women engineers have pretty much been abolished. I expect that there are enough good women engineers and enough men that have come in contact with them that they treat us equally. I don't expect any unusual treatment as a woman, and maybe because I don't look for it I haven't seen it.

I had one job interview in which the interviewer glanced at my chest after every few questions. I think he noticed how intensely uncomfortable he made me, but I couldn't say anything out loud and only wished he'd stop. He then directed the conversation toward issues of women in engineering and sciences, mostly centered around his elementary-school aged daughter. I didn't mind talking about it. He seemed to be on my side. And the incident was isolated.

Looking at grad schools I've taken notice of the numbers of female professors, of the ratio of male to female graduate students. But I know I can't expect much. The simple statistics of how many women graduated from chemical engineering grad school and when [they did] explain the scarcity of women professors. I've had very few women professors at Princeton, and I've felt comfortable speaking to all of my professors (though I don't speak to them much).

Jenny Lee '92, Civil Engineering and Operations Research

I've had three women engineering professors and each has been a different experience. One professor is very nice, but it was very painful to watch her teach. [I had her during] her first year teaching, and the guys in my class (I was one of about three females in a class of 50 or so) pounced down her throat at every single mistake that she made. She knows her stuff, but [the attacks] made her nervous and flustered. By the end of the semester, I ended up skipping many of her classes, but in retrospect, it would have been a good idea to have gone. Or even asked her for help.

Another professor was interesting because she seemed to have a split personality depending on what topics we were talking about. For example, if we were talking about sports or current events or anything not having to do with engineering, she'd be really laid back and funny—she had this biting humor about her.

However, when she was our *professor*, she tried to be intimidating. Even the guys in the class would joke sarcastically about her: "She's a wonderfully *warm* person, so *sensitive*, so *caring*..."

A female sophomore would ask a lot of questions in class and somehow,

professor treated her questions in a critical manner. A lot of times the professor would put her question off to answer someone else's question—usually a guy's. I never noticed that while I was in the class, but I do now when I look back on it. I remember the sophomore said at a SWE luncheon that she finds professors treating her differently because she's a girl. And now I realize that she *was* treated differently by this professor.

I also noticed in my interactions with this professor that she treated the guys differently: she seemed a lot more comfortable with them talking about sports or even about the subject. Call it my imagination, but I really believe that she preferred interacting with boys. I think she was very aware that I was scared of her. Although she tried to make me feel more comfortable, it seemed very forced. The atmosphere of feeling comfortable and laid back just wasn't there.

On the other hand, when I went to talk with the third female professor, I would feel very comfortable approaching her—whether or not I was in trouble or confident in how I was doing in her class, I still would take the initiative to go and talk with her.

Kathy Prestridge '92, Mechanical and Aerospace Engineering

Freshman year I was doing a lot with SWE—phone-a-thons, things like that. I enjoyed that, but I felt that it was a large group, and freshman year, I had a "women engineers—I don't want to get involved with that" attitude. This year and last year, I was on the undergraduate committee for our department. I really like that because I get to know the other people in the department well and keep on top of issues. There we have addressed not only educational issues but also those of sexual harassment. Through this organization, I feel that I'm helping to make a change within engineering; I feel that I'm contributing to change in our department.

I haven't felt that I've had anything personally affect me, and freshman year, I wouldn't have known what to label as sexual harassment. I think that I've learned a lot about that since coming here, and now I can recognize problematic attitudes that aren't right and shouldn't be allowed to go on. I know some people have had problems with professors.

There have been cases when some of my women friends have gone to ask questions during office hours and have been accused of making advances to get better grades or other such ridiculous accusations. If women sit together, which is very common—for example, Amy and I sit together because we're friends and we work together—there'll be comments like "Oh, you two are always sitting next to each other—Bobsey Twins. . . ." This has happened to other women in different classes.

To me, it's kind of unfair for people to say that because there are just as many guys who always sit next to each other. No one ever picks them out in the crowd, and the reason it happens is that we stick out of a crowd—it's the three of us women in a class of 30 people. The professors will learn our names first because

we're so easy to remember. Most of these things are just the way people normally act; it's not necessarily harassing or threatening, but it can make people feel uncomfortable. Most people don't like to be singled out of a crowd, unless it's for some achievement. It gets to be a stranger thing to do when people are singled out for something that they are; like "Oh, look at her; she's got a purple nose." People don't want to be singled out like that. Sometimes when you walk into a classroom for the first time, it's "There's the girl . . ." Students are like that—not so much now since we know our classmates.

It was difficult for me to first break the barriers of working in groups, with guys especially. They didn't seem to want me to be in the group. Working on problem sets, I felt automatically that I couldn't contribute as much as they could, being a woman.

Another thing I've noticed is when making friends, a lot of the women and men in different minorities tend to come together first. They will talk to each other casually first. As women sit together, so do people in minority groups—in our class at least. It is almost like a segregated seating section. I never really noticed it at first, but then I thought, "Who are my really good friends that are engineers?" And they're either women or black or Asian. They're not usually the white males who constitute at least half of the engineering population.

Lillian Yao '92, Computer Science

Academically speaking, fortunately (or unfortunately), I have never noticed any type of attitude against me just because I am a woman engineer. If anything, I am proud of the fact that I may be just one of the few women engineers. If I am the only female in a class, I am proud to have made it this far and make a personal mental note that I may need to work hard to show everyone that I am not dumb, but as I said, that is a personal note, not a result of any kind of interaction (bad or good) with anyone. If anything, I sometimes take advantage of the fact that I am female and have no qualms about asking a friend to walk me back from the E-Quad at night, or to help carry something, or to help figure something out. I have never perceived any feeling of being inferior because I am a woman and I am proud to say that my friends treat me as an equal, as do the professors, I believe.

One person who I have come to admire greatly is a female grad student in this department. Since meeting her, I look up to her as a role model: she is smart, quick, knowledgeable, and *very* nice. She has the respect of everyone as I have noticed, and it makes no difference that she is a female.

The only times when there may be some sort of difference felt is when guys make some sort of joke pertaining to sex or related topics. Then there is some embarrassment, but my friends usually are considerate enough not to do that or to do it only in a teasing manner which doesn't bother me.

In terms of the poor "ratio" amongst CS B.S.E.s, I don't mind that at all. I enjoy having male friends and at times, it makes me feel special. Then again, at times it makes me feel stupid.

I think the hype about discrimination against women is exaggerated. I don't believe I have felt any of that. At times, I really get annoyed by all the "publicity" given to that.

Cathy Miller '93, Computer Science

I haven't seen any direct evidence of any sort of discrimination or anything. I have noticed that the numbers—the proportions—are way, way off: four females in a class of 36; it has a slight effect. As of last semester, I started keeping a count of how many women were in my classes and [it turned out to be] somewhere in between four and six, except for the introductory classes where there were slightly more. As far as I understand it, there are only two females in the B.S.E. computer science department [my year]; I haven't encountered any other ones. So I think there are just me and Karen, sticking together.

Like I said, I don't have any direct evidence of any discrimination. I've heard rumors, like if you're a woman and your name was on a problem set, you might get scored a little lower, but I haven't discovered that in any of my math classes.

I don't think [the gender issue] affects much in computer science. There's no writing in it, just programming, and you can't really tell different styles. There's no female or male style. You've been taught format, and it will either work or not. It either looks nice or it doesn't; there's no gray zone. Or the gray zone is so small you can't really measure it.

Melissa Tamada '93, Electrical Engineering

EE has very few women, and I find that a little odd. I don't mind all that much since I like working with guys, but the fact that there are only four girls is bothersome.

Saying that you're an engineer [when you are a woman] makes guys feel they have to be superior. I went to a guy once and asked him about creative writing. I thought that it was a program, not a major. He was shocked that I didn't know about it, especially as a sophomore. I said, "Sorry, I'm in engineering." "Oh! I'm sorry for you," was his reply. It seems that men as A.B.s have an [inferiority] complex with B.S.E. women. I knew a man who was in engineering but switched to economics. When I ran into him later, he was shocked to find that I was in engineering. "Are you still in EE?" he asked. "When are you dropping [out]?"

Sally Voehl '93, Civil Engineering

I haven't experienced any up-front discrimination and no one has said to me, "You can't get as good a grade as me because you're a girl" or anything like that. I really haven't noticed anything in my problems sets being graded differently. I do my problem sets with a mixed group of guys and girls. Sometimes I'll get the point more and sometimes the point less. It actually is funny to compare with the people you did the problem set with, to see if you get the same grade.

There is a low number of women, it seems to me, in the [civil engineering]

classes, not as low as two or four out of 36, but maybe eight out of 36. I guess in the more basic courses, it could be something like 15 out of 60, but it's still a relatively low number.

You get to know the women in your department and you tend to stick together. You also get to know the guys. I really haven't found any subtle discrimination either. Maybe once in awhile, sitting with a group of guys, they might suddenly start talking about such and such a girl. Then you'll say, excuse me, I don't want to hear this part of the conversation. I've seen it the other way, too, where a bunch of girls are sitting around and we start talking about something. When a guy comes in the room, we have to change the subject.

The only thing I actually have found some people say is, "You're an engineer? You?" I don't know if that's insulting my intelligence or [if it's brought about by] the fact that I'm a blonde, Caucasian female—and that therefore I don't belong down in the E-Quad. I mean I don't know if that's supposed to be a compliment or an insult because I usually get that from A.B. majors.

If you have any sort of inclination towards the practical sciences, it's worth trying engineering. So many people are getting scared off by the word "sciences" and so many women are scared off by the fact that women are supposed to be the liberal arts type.

I see myself as an engineering major and I have an idea of what I'm going to do: I'm going to do something concrete and that makes me feel good. I can actually make my mark on the world, and I know how I'm going to do it.

> *One of the things about equality is not just that you be treated equally to a man, but that you treat yourself equally to the way you treat a man.*
>
> —Marlo Thomas

Critiquing Princeton: The Good, the Bad, and the Unresolved

Remember the joke about how many Princetonians it takes to screw in a light bulb? The answer, of course, is three: one to install the bulb, and two to talk about how good the old one was. At Princeton, we not only seem to prefer the status quo, but we actively mourn its passing. In short, we're more comfortable with the known than the unknown.

—John C. Sawhill '58

THE SWORD CUTS BOTH WAYS, AS THE OLD SAYING GOES: PRINCETON, RICH WITH TRADITION, HAS TO DEAL WITH TRADITION'S SUBSEQUENT INERTIA. DURING THIS PROJECT, WE FOUND THAT MANY WOMEN CHOSE TO ATTEND PRINCETON'S ENGINEERING SCHOOL PARTLY BECAUSE OF ITS MANY ACADEMIC IDEALS, INCLUDING THAT OF THE ENGINEERING HUMANIST. HOW CLOSE HAS PRINCETON COME TO THOSE IDEALS IN ACTUAL PERFORMANCE? HOW HAVE THESE STUDENTS TRIED TO BRIDGE WHAT GAPS THEY SAW OR DID THEY FEEL THAT CHANGE LAY IN THE HANDS OF THE ADMINISTRATION?

The Published Record . . .

From "Coeducation and Change in the Engineering School," *Princeton Engineer*, March 1969, p. 13

There Are Good Reasons Why Women Should Be In Engineering

The profession would severely limit its ability to perform well in the future if it continues to exclude the talents of women. Their insights and perspective can help bring to the profession that extra "human dimension" that is needed. The influx of a group of enthusiastic, dedicated, and talented women could provide the momentum necessary to solve some of the problems which have been facing us for so long. One would hope that the barriers against women have fallen or are

falling. . . . Indeed, discrimination because of sex is now a federal offense. And it appears that Industry is, in fact, willing and eager to have these women engineering graduates. But the problem remains as to how to entice them into engineering in the first place.

My initial desire was to expound all the ways we could attract women to engineering at Princeton. My final conclusion is that we can only do so by being an attractive and challenging alternative for all students. To create any "especially for coeds" program would be demeaning and false to Princeton's standards. For many years, engineering has been a "package deal" that one chose in high school. To enter at a later date was very difficult (a fact that I can vouch for myself). If Princeton were to make engineering more like the other departments of the University, we would not be excluding those who would like to join us later on. (A poll of recent graduates could yield vital information as to whether the broader and more basic engineering is of value or a hindrance in one's career?) I believe that a more "liberal" curriculum is both desirable and practical. And with the creation of a Public Service Engineering Program, the School would be much closer to the mainstream of student thought and concern. This could be an exciting and valuable development, and a meeting ground for many elements of the University.

While I have been concentrating on the undergraduate program, it is clear that all our efforts must be applied broadly. Thus, we should actively recruit college coeds, as well as high school girls, for the engineering school. In addition, qualified women engineers should be recruited for the faculty and appointed as members of the departmental advisory boards. In conclusion, I should again like to quote the Patterson Report: "Unless the University, its trustees, its faculty, and its students are ready to give continuous and serious concern and effort to what it can offer women for their intellectual growth and development; unless we are willing to accept as desirable that women will demand a quality of education in no way inferior to that offered men; unless we are prepared to acknowledge that the restricted roles of women in the past are outmoded, and the intellectual talents of women are an important personal and public resource to be developed and used with care and courage, unless we can embrace all of these things, Princeton should abandon all thought of admitting women."

It would seem that the trustees have accepted these conditions. I hope that the administration and the faculty of the School of Engineering and Applied Science will accept and honor them, too, not only for the liberal arts division of the University, but also for the engineering school. They are reasonable and wise thoughts for the University as a whole.

From "Women in Engineering: Educators Must Take the Initiative," *Princeton Engineer*, April 1972, p. 8–9

The deans of New Jersey's engineering schools, Princeton's among them, are now interested in making their institutions attractive to both sexes, according to

a recent news release. Unfortunately, a glaring *faux pas* in the first sentence of their announcement is bound to leave the men's sincerity and sensitivity open to question. The sentence, with italics added: "College-bound *girls* who want to compete equally with *men* in the choice of career might give some thought to the engineering profession, five New Jersey deans suggested today."

Another news release, prepared by a group of local feminists and distributed at about the same time, begins this way: "Most books currently being used to teach children to read are overwhelmingly male-oriented, according to a study of elementary school readers just published by a group of Princeton, NJ women."

Readers of this column who are attuned to the word "sexism" will recognize that the two releases deal with a common problem. In simple terms, for readers not so attuned, the problem can be stated:

1. Boys grow up to be *men.*
2. Girls grow up to be *girls.*
3. Things happen in the educational process to assure this.

As the women's news release goes on to say: "The women found that stories about boys outnumber stories about girls by five to two. Boys outnumber girls four to one in stories showing ingenuity, creativity, perseverance, strength, bravery, apprenticeship, earning money, competitiveness, and exploration. Girls exhibit such traits as passivity, docility, and dependency six times as often as boys."

A number of such studies by feminist groups now exist, and more are on the way. What most of them do is give the lie to the common assumption that women are as free as men to choose what they will do—and that they freely choose "the kitchen and the obstetrics wards." In fact, the studies say, the school system is loaded in favor of males and against females.

How would the Princeton feminists remedy the situation? "In the coming years there must be a drive in all educational fields to improve motivational incentives for this underrated, under-encouraged 50 percent of the population," they write.

And how does all this apply to women in engineering? Quite simply, the Princeton women's study implies that the business of recruiting larger numbers of female applicants to engineering schools may not be an easy one. A bunch of news releases, good intentions (however ineptly stated), and slick recruitment brochures probably will not do the job. Instead, if the findings of the feminists have any validity, some far-reaching educational changes may have to occur before many women become engineers. Engineering educators, meanwhile, can help by dealing with a number of likely problem areas. For example, they might:

1. Determine whether, if women received engineering degrees in appreciable numbers, they would be hired by anyone.
2. Determine whether employment policies within engineering schools discriminate against women.

3. Determine whether recruitment literature for engineering education—both that prepared by individual schools and that prepared by the profession—is addressed to both sexes without bias.
4. Determine whether existing courses and activities in an engineering school appeal equally to both sexes.
5. Determine whether the job placement office on campus can help women find jobs—if such jobs exist—as well as it can help men.
6. Determine whether high-school guidance counselors "screen out" young women who are potential engineering students.
7. Determine whether high-school science and math texts and courses are aimed preferentially at young men.
8. Determine whether secondary school teachers of math and science have greater expectations of males.
9. Determine whether a child's first introductions to science—in primary grades, at home, through the public media—appear to be male-oriented.
10. Determine whether the engineering school administration is honestly interested in educating women, or whether instead it primarily hopes that the women will act as bait for more male applications.

The last suggestion is probably the litmus test, and should be answered truthfully before any of the others on the list are tackled. As a colleague at another institution commented cynically: "I'm not sure that the engineering schools are looking for female engineering students; I think that what is really wanted is a number of girls on campus in the hope that the girls will attract more boys. With engineering enrollments declining the way they are, if the schools could attract more students by allowing the enrollment of alligators, I think they'd try it." If that observation is true, it helps explain why the New Jersey engineering deans are seeking *girls*—not *women.*

Assuming, however, that the motives of the engineering deans are sincere, there remain many obstacles to getting answers to the problems listed. Engineering educators will say it's not *their* problem; they'll quarrel with the way the feminists have gathered their evidence; they'll say their time is consumed with other, more important research and teaching; they'll say they lack appropriate funding, and so on.

Wouldn't it be exciting to see the engineering educators get down to business, roll up their sleeves, and do something about the problem, in the same way that they did something about the arms race and the space race? Granted, they can't solve the sexist problem themselves; but neither do they win wars or land men on the moon by themselves.

And if they really decide to try to remove the barriers to women in engineering, they will find very quickly that they have an ally not far from home: the nearest chapter of the National Organization for Women. What engineering educator will be bold enough to ask a woman for help?

. . . Personal Voices

Marian Ott '76, Civil Engineering

At Princeton I majored in civil engineering, focusing on transportation systems. After graduation I went to MIT and received a master's degree in civil engineering in 1978. I then worked for the U.S. Department of Transportation on research projects. Two and a half years later I moved to New Jersey and joined the state transportation department to work on transit plans. In 1982 I went to Nashville to become the assistant general manager of the bus system there. For the last three and a half years I have worked in a San Francisco firm that performs transportation consulting. Currently I'm in the process of moving back to Tennessee to join a government agency.

My decision to study engineering was not a conscious one. The Princeton application had a list of potential majors, and urban engineering looked the most interesting. In high school I was good at math and science, but I had a bad guidance counselor. Nobody mentioned that I should take physics before college, so I started out behind in engineering, but my freshman adviser at Princeton was very encouraging. He came into school from home to sign my course cards when I was worried about what physics course to take. He told me not to be too concerned about my weak background in physics, since I had taken calculus in high school; he said that I might not get an A, but that I would be fine.

My thesis adviser was Alain Kornhauser; his attention and motivation were inspiring. The thesis is one of those things you hate while you're doing it, but you're glad you went through it. When I hire at my job, I give an edge to people who have had some sort of experience focusing on a big project.

Since I was the first female student in civil engineering, I was the only woman in most of my classes. I often had nobody to work with on problem sets, and I usually was not invited or encouraged to work with my classmates. Many of the guys were more than willing to help me, but often they would refuse my help and not give me the opportunity to show them what I knew. I missed the opportunity for camaraderie with my classmates. My year, most of the civil engineers were in Cottage Club, which was all-male at the time; I would have liked to interact with my classmates outside of the classroom.

What I liked best about Princeton was the vitality of the University and the interest of the faculty in the students. I noticed this in my liberal arts classes but especially in the engineering school. When I was at Princeton, the transportation program was new; the people had a great deal of energy and enthusiasm.

Anonymous '85, Mechanical and Aerospace Engineering

During my engineering studies at Princeton, I never felt that I was at a disadvantage because of my gender. All students were expected to complete their assignments, and no conditions or exceptions were made due to gender. Professors in the courses I took treated all students equally, and there was a similar

equality between male and female students. It was only once I graduated that I observed instances where some colleagues and superiors did not share an "enlightened" view of female engineers, probably because there were so few of us. However, at my present job, women engineers are well represented and are generally accepted by their colleagues and superiors.

The real problems at Princeton seemed to lie in the way engineering students had to work compared to many liberal arts students. The "grade-flation" so often mentioned about A.B. courses was absent in the engineering school. Good grades did not come so easily. In my experience, I found that it was more difficult to receive a good grade in a 300-level engineering course, for instance, than it was to achieve the same grade in certain 300-level liberal arts courses, such as in the departments of history, architecture, or comparative literature.

In retrospect, the first few years in the engineering school were overwhelming. I discovered that successfully completing an honors math and science program in high school did not ensure academic success at Princeton. Freshman and sophomore level professors and teaching assistants tended to breeze through material without realizing that much of the subject matter was entirely new and extremely confusing. Many of them tended to be inaccessible to undergraduates and were not overly encouraging. I also recall a large number of students dropped out of the engineering school during sophomore year, perhaps due in part to the above-mentioned difficulties.

However, through it all, I feel that Princeton provided me with a good foundation in engineering and the opportunity to study under some superior professors. In addition, the engineering school's focus on teaching theory rather than application has enabled me to think critically, which has given me a distinct advantage compared to engineering students from other institutions.

It appears that the engineering school is attempting to remain competitive with other universities, and as long as this continues, future Princeton engineers will continue to benefit from the "Princeton Experience."

Shara Lewis '85, Civil Engineering/Architecture

The A.B. courses seemed more social. I was able to do some reading, some thinking, and then go to class and contribute. It was easy to get a lot out of an A.B. course without as many hours of preparation. I felt that this interaction was missing in my engineering classes. The problem sets were very time-consuming; I used to stay up until 4:00 a.m. to finish them and then be too tired the next day to pay attention fully.

Engineering precepts tended to just go over the problem sets. It would have been better if they helped students see beyond the theory to the practical examples. They could have helped us understand how engineering works in the real world.

Engineering courses at Princeton don't teach students to question. The professors seem to imply that there is only one right way to look at a problem.

They didn't encourage creative problem-solving. Maybe the advisers could encourage students to take more electives in the humanities—ones that the students may find really interesting even if they haven't taken a similar course in years.

I went abroad to England, and it was a great experience. I arranged it on my own since there was no way to do it through the engineering school. As a result, I almost didn't graduate since Princeton did not accept the engineering courses that I took while I was over there. I was advised to go to summer school which is why I had to take two full time courses at WPI. I think the engineering school should set up some programs [for students to study abroad].

I found that the professors who were doing a variety of activities were the ones with the most perspective—they were researchers, teachers, and consultants.

[If I were to suggest anything to the engineering school, I would say that they should:]

- Encourage professors to incorporate practicality and reality—they can still teach theory, but to make the precept link the theory to the reality.
- Provide better engineering counseling and advising and help engineers be well-rounded people. Encourage them to take courses in other fields, not just advanced engineering courses.
- Encourage creative thinkers. Encourage students to question and to analyze.

Jackie Holen '86, Civil Engineering

Looking back on the Princeton engineering experience, which overall was for me extremely positive, I must criticize a few courses for their style. I do not believe in intimidation tactics in teaching, and I think that the approach taken in such courses as Physics 103/104 and MAE 305 was not productive. These classes left me without much confidence and, I think, with less comprehension of the material than I would have obtained with a more constructive approach.

Frankly, mathematics, physics, and engineering are hard. I find they are harder than liberal arts subjects because before one can reach the point of understanding the interesting questions, one has to acquire the basic skills—tools, really—to do so. Before reaching that point, one has to take it on faith that one will enjoy the subject when one finally figures out what it is! Acquiring the tools requires, for most students, ability, creativity, and *a lot* of diligence. At 3:00 a.m. when the problem set is still far from finished, it's not always easy to answer that nagging question, "*Why* am I doing this?" But, consider a student of English literature: a freshman could attend a senior or graduate seminar, and though she would not necessarily know all the terms and would not have the background or intellectual maturity of the upper-level students, she could understand the general topics and could be immediately inspired to pursue further study. An average freshman attending a senior or graduate level seminar in fluid mechanics will not get much out of it at all—and might easily be discouraged.

But mathematics, physics, and engineering are wonderfully logical, and both

pose and answer fascinating questions about the world around us. There is a beauty to the methods, to the creative solution to complex problems. The subjects are rigorous—there can be one answer, and even if there is more than one, there are usually ways to check if an answer is wrong. This kind of problem solving poses a challenge, but a very satisfying one. Many concepts which initially baffle a student later seem clear and fundamental.

I think that these aspects—the problem-solving approach and techniques, the beauty of the reasoning and the elegance of a good solution, the underlying logic—should be emphasized in introductory classes. Teachers should teach, not intimidate. The material is intimidating enough as it is. Furthermore, it seems likely that the "weeding" technique leads to greater attrition among students who are less prepared or less inclined to be in science and mathematics anyway, that is, women and minorities.

Jennifer Bonini '91, Civil Engineering/Geological Engineering

I applied for Ph.D. programs and decided to go to the University of Arizona. Part of that decision was a desire to go out West; I want to do more subsurface stuff. I applied to the Ph.D. program but may stop at a master's. It's one of the hitches along the way, and I want to keep some flexibility and freedom.

I really would like to see myself doing more hard-core stuff, either with consulting groups or within industry. I can't really see myself in academia. I have a rather bitter perspective on it, seeing the way things are changing. [Since my father is a professor here,] I have an inside line on how the geology department itself is changing its focus and is turning completely away from the undergraduates. This discourages me because its focus on undergraduate education is one of the reasons [it's such a good department].

I'm seeing this change not only on the departmental level, but also on the broad scale: Princeton is going more toward the graduate program and graduate prestige because that's where the money is. While research and such is important, the undergraduate education here shouldn't be compromised in the process. With these changes, it might stay on the same level with MIT or Harvard or Stanford, which have huge world-famous graduate programs, but what makes Princeton different is the challenging and excellent undergraduate education. I will always be convinced of that.

Getting in is not the hard part; surviving this place is. For the many people here who are used to doing well, that's not easy. But the challenge makes you grow and expand because it makes you search and find out what you really want and what you can do. Graduating from here is a great thing, not just because you have a degree from Princeton, but because Princeton challenges you by not making it easy. That makes it worthwhile in the end and forces you to learn about the subject and about yourself.

That education will change if the departments start turning away from undergraduates. Half the reason the geology department is fantastic is because

it's so personalized. It's very much a family—you're there, you're all learning together, you interact. It's such a healthy environment to learn in. Without it, undergraduates are going to be far more on their own—more isolated. For me, that's really sad to see, especially since I've had such a strong involvement with Princeton my whole life. It's a place to be proud of and the undergraduate experience is something worth keeping.

Amy Fronduti '92, Mechanical and Aerospace Engineering

I think it would be awesome to have a woman professor, but I'm very scared of pushing the hiring of a woman just because she's a woman. I don't know enough about what goes on in their search processes to know whether they are not looking at women at all (pushing them aside because they are women) or if they just haven't happened to come across as many qualified women as qualified men. I'm sure the pool is larger for men. I have to know more about [the issue] before I say it needs to be changed. I'd love to have a woman, but not at the cost of having a professor who isn't as qualified.

I think there is a lack of role models—and I'm not sure how to fill that gap. I wish there were someone I could go to and say, "Well, how does it work to be a professor and have a family? To balance these things?" There's no one to talk to about that sort of thing. I could probably go talk to some of my male professors about how they balance their home life. I know that some of them are very concerned about it; I've talked to some. The reason that some of them come in late and work late is so they can spend time with their kids in the morning. But still, it's not quite the same, not the same concerns.

Something that is really good is the interactor program. Having the upperclass students [help out first year students] has worked out well, but I wish there could be more involvement throughout the whole year. It's a very concentrated thing in the beginning, and I know it could be up to the interactors to do more—I'm one—but it becomes very difficult to push yourself to find the time. If there could be more scheduled activities, it'd be easier. I felt freshman year that if I had more input from upperclass people in my own department, I'd have known better what courses to take.

I feel that I made some choices that could have been made better. My adviser at the time could have shown me more options. He may not have known about them but maybe should have known.

The advising is much better once you get to choosing your junior and senior courses because you tend to have someone who has been doing this [level of advising], and is involved teaching those courses and knows what you should be taking. But freshman year, you're taking physics, chemistry, math, and computer science, and these professors don't know about the courses—which is understandable—but I think in order to advise, they should find out more about them or at least have some resources that they could point you toward.

I didn't have to take computer science because I placed out, but nobody told

me I could take one of my sophomore level courses early in order to make sophomore year less horrible than it was. I ended up taking a classics course—which was a great course—but it would have been better to take it sophomore year when I needed a break more; nobody told me these things. Maybe the freshman and sophomore level advising could be improved.

I've had some really excellent professors, some professors who did an adequate job, and some who were really bad. When you feel that you're spending a lot of time and a lot of money to get a good education and you're not getting it; that's frustrating. There are some professors who know their material so well that they just expect you to pick it up. They go too fast—I'm not just saying too fast for me, but too fast for the majority of the class, and there may be four people who can sit there and keep up with them. I don't think that is quite fair teaching. If the majority of the class is not keeping up, the professor should slow down and not have the attitude of "Well if you're not keeping up, it's your fault." I've run across that. That's got to be the most frustrating because this person is *capable* of teaching me better and just doesn't care enough to slow down. Whereas some of them are *trying* to teach you, but are just not making it. Or they just don't know how to be interesting.

There needs to be a little more discussion between professors [concerning projects]. Reading Period is supposed to be time to study for exams, and I have not been able to study for an exam since my freshman year because *all* of my professors decided that projects are good, and *all* my professors decided that [room] D-229 is a good place to do projects. You can't get a computer there anyway, so I think there needs to be more discussion between professors about who's assigning what for what classes. They seem to figure, "Oh, there are 25 students in my class so that's not much of a drain on the resources." Then again, there are 15 other classes using the same thing. It's beginning to seem like every class has a project.

Reading Period is "Project Period" so that you can work 16 hours a day on your projects instead of going to class. Either there isn't time to do them during the semester or there is, but we haven't learned enough [material] to get started on them seriously.

I don't know if there's any way around that [requirement of taking five courses a term for four semesters]. I feel that it hinders my learning, though. When I have five classes, I can learn four of them well, or I learn all of them moderately well. Somehow there is a trade-off. It doesn't seem possible to learn five well, although apparently it is because some people get straight As in my classes several semesters in a row.

The only A.B.s I know who work as hard as engineers are those who are very compulsive; all their work has to be done perfectly. (Or architecture majors—they are a class unto themselves. Architecture is like super-engineering; from what I've seen it can be pretty rough.) These compulsive people find the need to

work as hard as an engineer in order to do everything perfectly—and then some. I have a couple friends like this—extremely compulsive workers. Whereas I work this hard just to barely finish things.

I find it really frustrating to see these compulsive people spending so much time on projects. I wish I could spend that much time on something and really get into it, but I don't have time; I have to just do it.

I'm not a Type A personality anymore. The engineering school has just beat it out of me. I tried to explain this [concept] to my boyfriend. "It's okay," I told him, "You don't have to do that much." They beat this out [of me] my freshman year, and I'm still alive; things aren't perfect anymore, things just get done.

In the future, I want a good [grad] school, but I don't want this. This is getting better, but I don't want MIT which is worse than this. [In comparison,] this is do-able; this is fine.

Katherine Haskell '92, Electrical Engineering

When I was in 6th grade, I got interested in computers, so I came in from that angle: trying to understand how computers work. I always tried to find out how things worked. This habit, combined with my fascination with computers, pulled me further into electrical engineering.

Sometimes I feel over-challenged, but I try not to think of the negative aspect. I figure it's all within reach if I just push myself hard enough, but the thing is, do I really want to make those sacrifices [in social and personal time]? I've been pretty happy with the level of the courses, though.

I do end up blowing things off occasionally. You know you're not going to fail or make a C as long as you do something, so a lot of times, I'll be "who needs the A?" It's not that important to have an A in a course so I make time for social activities. I like to go out and do things, but [going out] every other week doesn't always happen.

I wish they had more hands-on activities. I feel that when I have more experiments and labs and am actually doing things with what I'm learning, I achieve [a higher] level of confidence with the material. A lot of the time they throw theoretical material at us, and we're expected to grasp it. Personally, it's hard for me to feel confident if it's just a bunch of numbers that has no basis in actual experimentation and something in real life. But that's my personal conflict with the way Princeton deals with concepts. In general, all of Princeton is theoretical, even its sciences. But I think it's hard to achieve [a high] level of confidence without applying it.

When I'm in a computer engineering course that uses the actual computer hard-ware, I feel better, more confident, and more interested—but that's because it's my field. When I go into something like signal processing, I'm not as much into it and don't feel as confident.

I've been throwing a lot of different ideas around about my future. I might go back for a master's in computer science. I'm really not interested in further

degrees in electrical engineering. I don't quite know why. Maybe because I'm more confident in computer science and programming. I do better overall in those courses. Maybe it's because that's a more hands-on type thing. You get instant feedback from the program, and I get more fulfillment from that than from an electrical engineering course here which is all numbers and writing down equations and formulae. That might change once I get into the real world and start using electrical engineering in a practical manner.

I want to go into industry for a while, then maybe go back, get an M.B.A., and go into consulting on my own; that way I can have my own family. Working out of the home would be optimal because I don't want to leave my kids alone. It's useless to expect the guy to stay at home. I'd rather stay at home anyway because I want to see my kids grow up.

Vickie Pisowicz '92, Mechanical and Aerospace Engineering

I would like to see more application in the engineering school because a lot of the material is theoretical. As far as workload, I think that some of the work sophomore year should be re-evaluated and distributed a little differently.

Taking all those sophomore courses together should be reconsidered because for some people, it's just really bad. A college education, especially for what we're paying, should be better than that. A lot of the problem [comes from the students because] once we get through with it, we don't want to deal with it or try to change it. It becomes, "Well, I lived through it, and I did this and that . . ." But we should want to have saved our sanity, too.

Susan Kim '92, Electrical Engineering

If you're an engineer at Princeton, they want you in and out in four years, unless there's some act of God, like you flunk out or something. It's a lot to get through; I know that people get through it every year and do fine. But there's a lot more to Princeton that a lot of us feel we're missing out on as engineers.

There are other kinds of serious and rigorous study that we'd like to do. A couple of people I talked to came here because it's more than just engineering. It's one of the selling points of Princeton: You can become a engineering humanist, but I personally have not found it to be true. My A.B. classes always suffer because of engineering projects I have to do.

One thing that EE people should know: They tell you it gets better after sophomore year. Don't believe it; it's not true. They make it sound like it'll be easier, but it's not. The teaching's better and hopefully you'll be more interested in the stuff, but it's just as hard. In EE signals, if you don't jump ahead in the beginning, it takes you a long time to get to what you really want to know. I didn't really have that opportunity and now I can't take the four EE courses that seem really interesting next year because I can't fit them all in.

It'd also be nice if there were carrels in the E-Quad. People in Firestone get carrels to put their books in and it'd be nice to have that for engineers, too.

Sometimes people spend really long hours at the E-Quad and there's no where to really sit when the library closes. If that couldn't be done, it'd be nice to have a student lounge.

The EE department has this nice new conference room with beautiful chairs, but students aren't allowed to go in most of the time. The other conference rooms are for grad students. I don't know what the other departments do, but it'd be really nice if the EE department had something. I realize there's a space problem, but sometimes I'm there late at night working.

Jenny Lee '92, Civil Engineering and Operations Research

Wouldn't it be nice if the E-Quad were a little prettier? It would be nice if they had huge windows, but not as ugly as the architecture building.

But more seriously, I hear from a lot of TAs and professors that our introductory EE class material is normally taught in two years at other universities [she started out as an EE]. I can't believe that. [Since we do it in one semester], maybe two semesters is more accurate. It's rough.

I also don't like the grading policy here. The deadline for changing your grading option is before midterms—before you even find out what your grades are in the class. I guess there are a lot of things that are very harsh, but I guess that's what makes Princeton competitive—being able to survive that kind of harshness.

I'm beginning to wonder what would happen if this place were nicer to us, like Brown or Stanford where I hear you can do plastic surgery on your transcript. I guess if this place were like Brown—less stringent—people would make fun of us like they do of Brown.

Kathy Prestridge '92, Mechanical and Aerospace Engineering

All the women in our department are secretaries—we have all male professors and all female secretaries. I think [getting women] would be the best thing in the department. Maybe not just a woman, maybe a minority, like a black professor (even a couple). You can say as much as you want and talk as much as you want about offering equal opportunity and being open-minded, but to have no one in there says to me that you're not looking. There are people who are qualified.

The department has to make the effort. The engineering school seems isolated from the main University in the management sense, and I think if there were stronger ties between the main University and the School of Engineering, then those ideas would spill over a little more. I think it just needs a little stirring up.

[As far as courses go, because of projects,] I haven't studied for my exams over Reading Period for a long time. Of course, they expect you to have been studying the whole time. The amount of work is very difficult to stay on top of. You don't really have a breather between any of the classes, so if a bunch of things

are due at one time, and one class's work isn't, you let that class fall behind. You neglect something to keep up with the other things. With engineers, taking five courses many semesters leads to these constant trade-offs. I finally took only four this semester, and I feel so much better! My state of physical and mental health is much better. I just did not believe that it could be so good.

It seems so imbalanced with A.B.s taking 30 courses and engineers taking 36. Usually the courses we have to take freshman and sophomore years meet seven hours a week. They all have labs, a precept, and three lectures. A.B.s will take these three-hour classes and have twelve hours of class a week. I had twenty hours of classes a week for three semesters in a row.

There's no weighting or point system—no credits, nothing to show how much more time our schedule took to do. It's not five courses of three hours each, it's two courses that are three to seven hours and three that are four hours or something. It just adds up to much more.

It would make me feel better [if there were some official indication] that I did put in that extra time. If they actually put down all the stuff we did [including design and lab courses], our transcripts probably would be many pages. People *know* that engineers do a lot of work, but unless they have an engineering roommate, they don't really know how much it is.

Lillian Yao '92, Computer Science

My favorite things about Princeton are the beautiful campus, the camaraderie that develops among a few good friends, and just the environment it offers for learning, academically and socially. My least favorite things are the emphasis on drinking and the somewhat cliquish, snobby, rich attitude that some people maintain. I think that is so high-schoolish and immature. What would I change in Princeton? That is a hard one. Something closest to me that I would like to change is the relationship between the Computer Science professors/grad and the undergrads, specifically some rules concerning the use of the computer facilities, the way the UGC (Undergraduate Council) is run, and the all-too-political handling of things. But that is a tall order!

Jennifer Leslie '93, Mechanical and Aerospace Engineering

When I have two days until a problem set is due, and if I don't get it done tonight, I can always do it tomorrow. If something comes up, like an extracurricular activity, I will definitely go for my extracurricular activity. The activity definitely would *not* come first if it were the night before the problem set's due. It's hard for me to say no to my extracurricular activities just because they're personal things and I see them as having more of an effect on the world than my problem sets. Maybe in the future, I'll be involved in designing a really economical car, but I don't see that as being as important as, say, starting a health program. I know my extracurricular activities give me practical experience that I'll probably use later in life.

I wish I had time to take more humanities courses because I love history. I wish I could take more French, politics, or anthropology courses. I kind of wish I had another year to take those courses, especially history, because if you don't know that, we're just going to keep repeating it—the old phrase. It really bothers me that there's no way to strike a balance here.

In high school it's easy—you take the history, English, math, and science courses because you have to have this broad background so that you can go to college and focus. I kind of was hoping that college would be something more like high school, especially since there are so many awesome courses here taught by so many wonderful professors. That was one of my biggest fears in becoming an engineer—I knew that I would be giving up a lot of those [choices].

I just wish that more of the faculty of the engineering school were women, and that the male faculty would be a little more open and receptive to women's issues. What I [hope that they] would see is that these [incidents of sexism] really do happen and say, "Look, we've mistakes, let's go on from here and learn from them and try to really change things."

Cathy Miller '93, Computer Science

One of the things I don't particularly like is the fact that the computer science program likes to see itself as a sort of boot camp where the only way to learn is to sit down in the computer room and hack for hours and hours. The way you *really* learn, though, is by tapping the shoulder of the people next to you in the lab and asking, "How did you do this?"—like "How do you get a printout?" After they tell you, you can ask them how they found out about this information, and they'll tell you they found out from another person that they tapped on the shoulder.

There should be a greater access to this [basic] information, but I guess part of the problem is the newness of the technology. We don't have many books in the library on the subject so you can't find all the information you need. It's very difficult to learn how to do something if there's no reference information available. I guess that's the price you have to pay for studying such a new field.

[Concerning the course load,] it's a little easier now that they've added the option of taking courses over the summer. But, it's not recommended for anything except for very basic courses like math or physics or something like that. To take something like a computer class outside the University seems risky for a CS major because the courses build on each other. They will assume you know such and such well, and if you took a similar course at another school, it might not be exactly the same. You might not have covered [that topic] as much or at all. It's not so bad for the basic or beginner courses because you can always pick it up later if you need it, but for some of the higher level courses it might be difficult.

[As far as advising goes,] I had a freshman adviser when I was in the electrical engineering department, but he didn't affect me too much because I switched

out of my major into the computer science department. This year, I like my adviser; he's very good. My only criticism of the advising system is that I meet my adviser a couple times a semester: once at the beginning of the semester and once at the end. They really should have more continuous advising in the department so that you can figure out what you want, what you want to do for independent work, or whatever. I haven't been to the [departmental] open house so I really didn't talk to any of the other professors.

[The professors] have very busy schedules, but they're very approachable if you can catch them while they're in. Electronic mail is definitely key. The CS professors check it all the time; they're always logged on.

Melissa Tamada '93, Electrical Engineering

I'm president of the International Students Association of Princeton (ISAP), am on the ski team, and am a dorm health aide, which takes some time for preparation. Being president of ISAP took an awful lot of time this year—20 hours per week if we planned events, for 30 weeks.

As a result, I am attuned to situations involving international students. For example, I've seen some getting "attacked" by professors. Their English sometimes isn't that good and the format, even the meanings of terms like "pipes," are not obvious. It's very aggravating to see professors jump on students when they ask basic questions in order to understand the material better.

In terms of improvements for all students, there should be more contact with the E-Quad for underclass students. The first year ties engineers to physics, chemistry, and math more than to the engineering school, so a lot of students have no real idea about engineering. Maybe there could be a compulsory introduction to engineering in which professors from different departments rotate as lecturers.

Sophomore year and freshman year I had the same EE adviser. It was luck, but it was nice since it gave me a sense of being in the department early. The directors of studies [of residential colleges] don't know the nuances of the courses, and they say that you can't take five courses your first term. On the other hand, my engineering adviser said, "Try it and see."

The engineering adviser has a better idea of how much work classes will require, and what they are about. I happened to ask my adviser pre-med questions, too. He ended up talking with me for two hours about his experiences and the variety and breadth that the field had to offer. When I still wasn't sure about my major—I thought mo bio [molecular biology] might be the more direct way to med school—my adviser was very encouraging, saying that I could even take a year off if I wasn't sure about what to do after graduation.

With EE, most students have their adviser for at least three years. In the A.B. program, it is only the senior year when they are able to know and appreciate their advisers. My boyfriend told me that his junior-year adviser's schedule was

full. How can you get to know your professor (or talk for two hours) when the schedule is so tight?

The engineering school is one of the best organized of all the departments. That's probably because the people who run it are from engineering themselves and are geared toward organization.

Amy Teske '93, Mechanical and Aerospace Engineering

As vice-president on the engineering council, I'm sure I could come up with three or four pages of suggestions for the engineering school, but on the spur of the moment . . . I've heard a couple of issues addressed in particular: Be aware of the situation of the female engineers and the fact that we don't have any mentors in the engineering school because there are not many female engineering professors and none in the MAE department. Another thing to keep in mind is that we have a set program; I came from a program in high school where everything we did was new and open for change. This program is very rigid, structured, and set in its ways; sometimes I think there should be more flexibility.

They should look at the requirements and expectations and review what should be emphasized. I've taken two classes this semester that I think are totally pointless; I'll never use the information again in my life, but I'm required to take them.

The course work often is very theoretical, not much is applied to life. The dynamics course has been so theoretical that when we actually applied it to a suspension system on a car, I found all these results that I have no clue how to interpret. That's really frustrating.

There are so many rich traditions and high expectations here that I think in some ways they do a lot of good. The faculty is really looking at each of their students. A lot of the professors in the E-Quad know my name. Maybe it's because I go over there and bang on their doors every once in a while, but it's a good feeling to know that they care.

I have another friend who's out at University of Pacific in California in an engineering program. He failed one of his courses and had to retake it during the summer. He was making all the decisions on his own with no one to help him. We have a pretty strong support structure; I don't think you really realize it until something goes wrong, and then it kind of closes in on you.

I am here because I like what I'm doing. I like being female, but it's not something that I need to overcome in order to become an engineer or something that I think anybody should give special attention to. I am who I am and I like what I'm doing now. It's a good feeling because I think I'm going to make it.

Excellence is the product of extensive *correction.*

—Emery

Graduate Students: A Small Sampling

Speech is civilization itself.... It is silence which isolates.

—Thomas Mann

MANY PRINCETON UNDERGRADUATES AND ALUMNI VIEW THE UNIVERSITY AS PRIMARILY AN UNDERGRADUATE INSTITUTION. SO MANY OF THE RICH PRINCETON TRADITIONS REVOLVE AROUND UNDERGRADUATES—CANE SPREE, ARCH SINGS, PROSPECT STREET, AND THE EVER-POPULAR NUDE OLYMPICS, JUST TO NAME A FEW. THE GRADUATE SCHOOL IS SMALL AND SOMEWHAT REMOVED FROM UNDERGRADUATE LIFE. FURTHER-MORE, ENGINEERING GRADUATE STUDENTS ARE OFTEN ISOLATED FROM THE REST OF THE UNIVERSITY AND, MORE THAN UNDERGRADUATE WOMEN, FEMALE ENGINEERING GRADUATE STUDENTS CONSTITUTE A SMALL MINORITY AT THE E-QUAD.

IN JANUARY OF 1991, WE SENT LETTERS REQUESTING SUBMISSIONS TO THIS PROJECT. THESE MAILINGS WENT TO UNDERGRADUATE STUDENTS AND ALUMNAE AS WELL AS CURRENT GRADUATE STUDENTS. TO DATE, ONLY THREE GRADUATE WOMEN HAVE RESPONDED. THIS LOW RESPONSE WAS PROBABLY BECAUSE OUR INITIAL GRADUATE SOLICITATION POOL WAS SMALL; WE DID NOT HAVE ACCESS TO THE GRADUATE ALUMNI NETWORK AND THUS COULD NOT SEND INDIVIDUAL MAILINGS TO GRADUATE ALUMNAE.

THE GRADUATE EXPERIENCE IS A VERY DIFFERENT ONE FROM THE UNDERGRADUATE AND WELL WORTH INVESTIGATING. INTERACTIONS WITH FACULTY AND COLLEAGUES, PERSONAL MOTIVATIONS, AND UNIVERSITY ATTITUDES ALL CONTRIBUTE TO THE UNIQUENESS OF THE EXPERIENCE. ALTHOUGH THE THREE CONTRIBUTORS MAY NOT PROVIDE A FULLY ACCURATE OR DIVERSE LOOK AT GRADUATE WOMEN IN THE E-QUAD, WE INCLUDE THEIR SUBMISSIONS SO THEIR VOICES CAN BE HEARD AS THEY DESCRIBE BOTH THE JOYS AND FRUSTRATIONS OF GRADUATE STUDENT LIFE IN THE ENGINEERING SCHOOL.

The Published Record . . .

Press Release from Princeton University, July 21, 1971

Twin sisters from France, studying for Ph.D.s at Princeton University's School of Engineering and Applied Science, are the joint recipients of an Amelia Earhart Fellowship Award, an advanced research and study grant offered by an international service organization of executive women in business and government.

The $3,000 grant, awarded by Zonta International, will help the young women continue a stay at Princeton that began unexpectedly during a 1969 visit to the United States.

That "vacation" has never ended for Josette and Larisse Rosentweig, now graduate students in Princeton's Department of Aerospace and Mechanical Sciences. Residents of Saint-Ouen, France, a suburb of Paris, the twins hold masters degrees in mathematics from the University of Sciences of Paris, and were embarked on a doctorate program in applied mathematics there until their 1969 visit to America.

Now Larisse is using her mathematical background to work on theoretical problems associated with flutter, or structural vibrations, particularly in aircraft. Josette, also a theoretician, is studying the problem of noise suppression in rocket engines.

The twins, who are fraternal rather than identical, are not the only women in the Aerospace and Mechanical Sciences graduate program. They are joined by Genevieve Segol, by coincidence also a resident of France, who has been enrolled here since 1969. Miss Segol, who received her masters degree in June, is the first woman to hold a Princeton engineering degree. She is continuing her stay here toward the Ph.D.

When Misses Rosentweig arrived in the United States for a summer vacation in 1969, friends in Elizabeth, NJ, suggested a tour of an American university: Princeton. During their campus visit they talked with several faculty members. Impressed, one of them suggested they both apply to the University, and in September 1969, Josette did.

Her qualifications proved impressive enough for the Graduate School, in an unusual move, to admit her mid-year. She formally enrolled in February 1970, although she had been attending aerospace seminars and an occasional class during the fall term.

Shortly thereafter Larisse also applied and was admitted in September 1970. Before enrolling she lived in New York City and worked as a research analyst for a life insurance company.

Since 1970 they have shared dormitory quarters in Princeton's Graduate College. Although each brings her mathematical background to engineering problems, the problems themselves are in such different areas that the twins do not collaborate in their research.

Both young women are contemplating academic careers after they have finished their Ph.D. work.

From "Engineering Pioneers," *The Penn Stater*, July/August 1991.

"In 1964 I applied to several graduate schools; one of them was the chemical engineering department at Princeton," [JoAnn Yamas Yurchak, Pennsylvania State University, '64] says. "I received a very nice letter from the department explaining that they wanted to accept me, but that the University rejected me because I was a woman. It explained that the University accepted graduate women, but only in areas where they could not get an adequate education somewhere else."

Yurchak's daughter, Lara '91, graduated from Penn State University Phi Beta Kappa with a B.S. in molecular and cell biology and was accepted into Princeton's graduate school. She has decided to go elsewhere.

. . . Personal Voices

Jean Cho GS, Civil Engineering and Operations Research

Last month, on a plane from San Francisco, I sat next to a Japanese businessman who snorted when I told him that I was a civil engineer. Literally snorted. It was as if he knew that in the United States in 1991 people do not openly sneer when women enter engineering fields, yet he was woefully unsuccessful at suppressing his disdain.

I was surprised by the physical nature of his reaction but not offended. I have grown accustomed to the often poorly-masked scorn directed at me as a female engineer, but I do not take offense when it comes from a stranger. (It is another story when the scorn comes from an acquaintance, but I'll get to that later.)

Five years ago, as a senior at Stanford, I would have been offended but not surprised, because five years ago I felt a vague sense of invincibility, a belief that I was uniquely capable of entering a male-dominated world, of weathering all ordeals, and maybe even of single-handedly changing it. As an undergraduate, I expected encouragement, and it was freely offered from all sides, from family, from friends, from faculty, from other students.

I was not an engineer as an undergraduate but an earth scientist, and that might explain some of the differences I have experienced since coming here. Although all the professors in my undergraduate department were men, a good proportion of the graduate students were women. My adviser did his best to introduce me to as many graduate students as possible. And the graduate students, especially the women, became important to me as friends, as sources of information, and as role models. I did not observe any significant differences between the female and male students. Students had different specialties and different levels of expertise, but gender did not seem to affect the way in which

students were treated or to influence their ultimate success rate.

Many things changed after graduation. Most of these changes relate to the unavoidable differences in graduate and undergraduate experiences and to the inevitable differences between universities. I moved from the West Coast to the East Coast. I moved from a university that, although it pampers its undergraduates, values its graduates more than its undergrads to a university which, at the time, tried as hard as it could to pretend graduate students do not exist. I moved from a university that fosters much interaction between classes (frosh through seniors) as well as between undergrads and grads to a highly segregated one.

I moved from a university that seemed to have balanced its research and teaching obligations by honestly placing greater emphasis on graduate research without, I believe, jeopardizing the quality undergraduate education to a university that seemed then, and still seems today, to have an identity problem. The School of Engineering at Princeton is a conglomeration of research departments held together within a university that pretends to value undergraduate teaching more than graduate research. Graduate students are expected to work 40–100 hour weeks for the benefit of the University (while getting a degree), but the University is all the while running its services for the benefit of undergraduates. Excessive work hours, suboptimal support services—looked a lot like slavery to me at the time.

My first months here taught me things about being a graduate student at Princeton. I learned that as a graduate student, I wasn't particularly welcome in undergraduate student organizations. I attempted to renew my affiliation with Amnesty International and the Overseas Development Network (through the Princeton affiliate, the Princeton International Development Organization). Somehow I thought that my years at another university would make me a worthwhile resource at these organizations, especially since the Overseas Development Network was originally created by a graduate student at Stanford, whom I knew, and his brother at Harvard. But in any case, after my years of peaceful coexistence between grads and undergrads, I was unprepared to learn that Princeton undergrads would rather do it themselves and that the University administration preferred it that way. In the end, I found it difficult to fit other activities into my onerous research/course-taking schedule, anyway.

Things have improved since my first year here. With the formation of the Graduate Student Union, graduate students at Princeton have a voice we lacked when I matriculated. The status of graduate students within the University community is gradually improving.

Most of my negative experiences at Princeton, especially during my first few years, are related to my status as a graduate student. But some of the difficulties I encountered since then are gender-related and are being addressed slowly. My undergraduate department had a 50-50 male-female split. At present, I am one of two woman graduate students in my program of 18 students. The so-called "ratio problem" at Princeton did not bother me when I first arrived here. As I

mentioned, I felt invincible in the face of the male-dominated engineering field I chose to enter. And, indeed, during the first few months here, I was blissfully oblivious of the sexism in the E-Quad. After all, this was the late 1980s, when sexism was no longer blatant.

By the first winter, just as I was resigning myself to the fact that as a graduate student I was a second-class citizen at Princeton, I began to notice little manifestations of sexism. They were usually very subtle, like a professor always asking one of the two women in the class if they understood what he had just said. The only nearly blatant show of sexism I can recall is the frequency with which I heard fellow (male) students tell me that, as a woman, I would have no difficulty finding a job. At first these comments did not strike me as sexist, and I do not think that, for a moment, these men thought they were insulting me. To them, it was a statement of fact. At first, I was mildly annoyed, but given the undeniable fact that engineering employers around the country have stated, on paper, their interest in increasing the number of women they employ (at least at the entry level), I, too, resigned myself to the apparent verity of these statements.

As time wore on, I learned little facts here and there that made me angry that my peers were repeating the mantra about female engineers having it easy. They are wrong. The attrition rate among women in engineering departments remains atrociously high. In a study, it was found that when two identical professional papers, one with a female author and one with a male author were sent in for review, the female author consistently received less favorable assessments. Identical resumes, one with a woman's name on top and one with a man's name, were also evaluated differently. It was consistently concluded that the woman was less qualified. So when, given two equal candidates, the woman gets the job, how equal were they to begin with? I have come to suspect that the woman usually deserves the job but that the search committee often does not want to believe it. (The studies I mention were conducted during the 1980s and are described in Sheila E. Widnall's "AAAS Presidential Lecture: Voices from the Pipeline," *Science*, v.241, p. 1740–1745, 30 September 1988.)

As a woman, I must jump over many hurdles of negative bias that my male counterparts never encounter. These hurdles confront me many times before that final, affirmative action-inspired choice of the woman over the man. I do not look imposing at the podium. My voice does not resonate in baritone, commanding respect. These things count against me because in the end, regardless of the profession one chooses, stereotypes and attitudes matter.

The problem with affirmative action is that it changed the *rules* of hiring but not the *attitudes* that created the original lack of women in work place. The imbalance between the attitudes and the rules leads to accusations of unfairness. It leads my male colleagues to assume that affirmative action will give me an unfair advantage. Negative attitudes toward women and our capabilities are still prevalent. Sometimes, I think that outmoded attitudes toward women have found something of a haven in the academy, where after approximately seven

years (usually at around 35 years of age), a professor is guaranteed a job for life.

This professor, traditionally male, continues to teach and do research in relative isolation from the rest of society, carrying around often unchallenged beliefs from decades ago. Even today, at Princeton, there are professors who do not believe women can excel in engineering like our male counterparts can. There are professors who believe that women are inherently less devoted to their work, that women will abandon all other responsibilities someday and become full-time mothers. The demise of these negative attitudes toward women cannot be legislated with affirmative action alone but must occur individually over the entire population.

Women for years have collided with these stereotypes and attitudes (you know the ones: that women cannot reason spatially, that girls shouldn't aspire to be mathematicians). It has been shown that, as girls and boys progress through elementary school, middle school, high school, and college, that female students do better academically than male students, but that the self-confidence of girls/women steadily decreases while the self-confidence of boys/men remains the same or increases. Finally, in graduate school, women as a group have almost no self-confidence left. (This study is also discussed in Dr. Windall's lecture.)

Like many women in engineering, I went through a crisis of self-confidence. Ironically, it occurred shortly after I passed my general exams. I didn't feel capable of finishing my degree. The thought of original research terrified me. I felt unprepared for the weekly brown-bag seminars, the committee meetings, the conference presentations, the final public oral exams. But I stayed because I didn't believe I could succeed in anything else, so the lack of self-confidence hit me both ways.

Fortunately, knowledge is empowering, and I've regained much of my self-confidence. I try not to interpret obstacles in my research as personal weaknesses, because I realize that my male colleagues do not blame themselves for their research misfortunes. Unlike most women I know, most men are prone to blame others or no one at all. This, I tell myself, is directly related to their relative abundance of self-confidence. I try not to take criticism personally. We women are traditionally socialized to please the people around us in ways that men are not, and in the working world, it is best to forget those early, often unspoken, lessons that we are not what we do but what others think of what we do.

I recall an anecdote told by physics professor Ruth Daly about a college professor who advised her not to pursue a degree in mathematics, without realizing that she was at the top of the class. Due to her lack of self-confidence and a tendency to believe the worst about her abilities, she followed his advice.

But I also know another story that, I hope, forebodes a gender-blind future. Last semester I attended an evening class called "Auto Mechanics for Women (and Men)" at Mercer County Vocational Technical School. When asked why he created the class, the instructor, David Cipolloni, said that, during his years as a teacher on the high school and vocational school levels, he discovered that in

general, women are better students than men and that in general, women are more interested in learning than men. But he also discovered that in shop classes, women tend to be uncomfortable and men tend to be antagonistic towards women. So he created a class where women, who are as able to become mechanics as men, can learn in a friendly environment. We need more men as insightful as Mr. Cipolloni, who is certainly doing his part to invalidate obsolete myths about the inability of women to be auto mechanics.

And even in the ivory tower, proud of its ability to ignore the outside world, things are improving. In the E-Quad, there is an increasing number of young faculty (still mostly male) who studied with women and respect our intelligence. And my department has, finally, one female professor.

We need to continue affirmative action programs to remedy past unfairness. But we should expend more of our energy fighting the attitudes that caused them. We cannot continue to combat the symptoms without addressing the disease. Boys must be taught at a young age that they are not biologically superior to girls in mechanical ability, spatial reasoning, and mathematical thought. Likewise, girls must be taught that they, too, can be engineers, mathematicians, mechanics. Only when attitudes toward women and women's abilities have changed will being a female graduate student in engineering be a pleasant experience.

I look forward to the day when no one is surprised to learn I am an engineer. And when my post-Ph.D. career begins, let no man insinuate that I got the job because of my gender.

Carla Schwartz GS, Electrical Engineering and Computer Science

I studied for my Ph.D. at Princeton in the Information Sciences and Systems (ISS) group of the then EE/CS department, during the period from September 1980 though July 1984. When I first entered the program, there was one fourth-year female Ph.D. student who was finishing her work and one third-year woman, and I was one woman in a class of seven studying ISS.

At the time, there were no women faculty in electrical engineering, nor had I had any women professors in engineering as an undergrad. I was used to being in a male-dominated environment, but I, like all the other students in my group, was also used to being at the top of my class; coming to Princeton was a bit of a shock all around.

I lived in the Grad College my first year, on an all-female floor in the New GC. I was hoping that would allow me to meet some women. I was surprised to discover how few women there actually were in the Graduate School, and as we were all immersed in our studies, it seemed [that] the only occasions we took to chat were while we were brushing our teeth. I quickly discovered that each woman had only time for her work and her lover, and not much else. It was not easy to make a jogging date, let alone develop a friendship.

Soon enough, I, too, found myself immersed in my studies and my lover.

In some ways, I can't classify my experiences as being unique to being a female graduate student in engineering, as I found many other female graduate students had similar issues to deal with: just being women in a predominantly male environment. What was unique to my situation was not having other women in my class to interact with, or team up with.

The second year was generals, and this was a tense year for us all. My six other classmates and I studied together, making sure we all knew how to solve the problems from the past exams. I felt both collegiality and competition amongst my colleagues. We discussed the exams to a point where it was a matter of confidence as to whether one passed or not. Somehow I stood my ground and passed along with five of the others.

Studying at Princeton had somehow humbled me and shaken my confidence. When I first went there, I had been used to being at the top of my class in all my studies. Suddenly I was exposed to new ideas and new ways of thinking and worked very hard to keep up with them all. When it came to studying for generals, I decided to take the two weeks just prior to the exams and escape to my parents' country home three hours away. That was the best move I ever made. When it came to the actual exam, I still felt strained to think about any ideas I had not studied, but I had conviction in my ideas, even when I was wrong, and I believe this helped me get through the exams.

After the general exams, we all relaxed a bit. The guys became buddies, and I was sort of out of it. They all played softball and basketball together, and since I didn't have these past-times, I didn't feel at all like one of the boys. What's more, I think the men were afraid to be friends with me, as they all had wives and girlfriends and didn't know what to make of a single woman as a friend. This separation played a role that would stay with me for the rest of my life. I find it's often in those other activities that much networking takes place—problems get discussed, ideas get thought out, etc., and I was left out of even having such possible interaction. By that third year, I was the only woman in the ISS program and remained so for the fourth year as well.

If I could summarize my encounters with my colleagues during my four years at Princeton, I say that for the most part, I was quite isolated as a woman and did not have a whole lot of interaction with my male colleagues.

My second year at Princeton I shared a Butler unit with a woman in geology. She was from West Texas, and we had very different philosophies. She told me that she couldn't understand why women would march to "Take Back the Night" in that day and age. She felt something like that would have been more appropriate in the '60s.

She also didn't appreciate my boyfriend staying over when she was around. This was a problem as in her mind, if my boyfriend were to stay over, she would want to stay with her boyfriend, and in turn his roommate would have to stay with his girlfriend. It was even more complicated for me, as in general, I spent most weekends with my boyfriend in New York where he was living, but

occasionally we wanted to spend an evening in Princeton. The long and short of it was this woman and I were of very different backgrounds, and it was quite an education managing to get along with her, especially during generals.

My next door neighbor was an applied math student studying chemical engineering. She was very nice, and we did become friends my final year at Princeton and set off cycling together. Since I didn't have much interaction with my colleagues by that time, I didn't feel the need to use her as an ear for any issues because there really weren't any.

One thing I noticed that year was, although I was invited for a lot of academic interviews, I wasn't offered nearly as many jobs. I suspected half the time that I was invited just to satisfy affirmative action while the departments actually wanted to hire someone in another field.

My outside activities at Princeton gave me much pleasure. I discovered cycling and explored the country roads on my own. I gained a lot of strength and independence through my exploration, although this incident I'm about to describe did shake me up: One August afternoon, I was out on one of my favorite rides—out to Neshanic Station and back. I headed out on the Great Road to Dutchtown and Plainville, headed over to East Mountain Road and turned left on Amwell Road. I was pushing hard and working up a sweat. It was sunny, but not too warm, so I was wearing my red poly-pro T-shirt and my black cycling shorts. The T-shirt fit tightly.

Besides concentrating on the ride, I was breathing the fresh air, taking in the scenery, and thinking about a problem for my thesis. My mind was wandering here and there. Just before turning off Amwell Road onto a small back road that connected to Neshanic Station via a footbridge, I noticed a man on a motorcycle pass me. A little way down the road, I noticed the man on his motorcycle again. He was wearing jeans and was short with dark hair and a mustache. He stopped to change his T-shirt.

Soon I turned and crossed the creek on the footbridge. I loved that ride, mostly because of that footbridge. The bridge had originally been open to automobile traffic, but as it was closed, cars had to go around a long way to get to Neshanic Station. The bridge enabled me to have an almost traffic free loop, with Neshanic Station as the apex of my trajectory.

I wasn't watching the man on the motorcycle to see if he was watching me turn onto the bridge, and I thought he had not seen me. I could have taken one of several directions. Just past Neshanic Station, which was a four corners type of town consisting of a general store and a gas station, I was racing along a flat passage past farm fields, with the wind at my back. I was lost in thought and didn't hear the motorcycle pull up behind me.

I almost jumped when I felt the hand on my breast. I turned and saw his evil grin as he was riding at a pace to stay with mine. I kept on riding and decided (in an instant) to be fierce—through clenched teeth, I shouted, "Get away from me. Get away from me." I didn't realize there had been other people around, working the

fields. The man stayed with me at my pace for a moment of thirty seconds, but it seemed interminable. Finally he headed on, and I heard voices call after me, "Are you all right?" but I was too upset to stop. I needed to keep going or I would fall apart. I was 20 miles from Princeton, and I rode back as fast as I could, all the while praying I wouldn't see that man again, all the while holding back the tears.

My other activities at Princeton were taking dance classes and creative writing and attending the local theaters and films. There were a few grad students in the dance classes and that made for some other supportive friendships. I even participated in one of the student dance performances, directed by Z'eva Cohen. That was a wonderful opportunity for me.

Anyhow, I could go on and on about my current hair-raising tales of being the only woman in an engineering school/department since I left Princeton, but that would take too much time write down. In any case, I thought I'd include a poem here, which may or may not be appreciated by any of your readers. I wrote it about five years ago:

Finger Fucking

Can the engineers
really make love
work
over the words
to digits
to words
network?

(Of course, that opens a whole other can of worms.)

Pamela Moyer GS, Civil Engineering and Operations Research

As an undergrad, I went to the College of St. Elizabeth, a women's college in Northern New Jersey. Part of the problem was that it was a liberal arts college, and I didn't major in engineering. I majored in math and started out as a chemistry major. I realized that I didn't really like the lab time, but I knew I was an analytical person and math seemed to be the road for me for these reasons. When I came to Princeton for engineering it was a culture shock.

Engineering was different from math, and Princeton was a much different place from St. Elizabeth. I lost my secure, comfortable environment where I was close to number one. I was frightened—I didn't [even] recognize [the technical] notation. I was not prepared. My background was not what it should have been to be a graduate student at Princeton. That didn't stop me; I was just doing double time on my work. I was working on things from an undergraduate and a graduate perspective at the same time.

I was accepted at five or six schools. I visited many and just decided that Princeton was a friendly environment. I look back now and think, "Wow, where

did I get this sense?" All the professors were very nice to me; the graduate students seemed happy. My family and fiancé were in New Jersey, so I thought that it would be a good support system to stay near. I was accepted at Stanford too, and I thought that if I went all the way out there, I'd be away from the people who could support me. I was also offered full tuition and a stipend to come here and there was no reason not to; the school had a great reputation.

All second year graduate students take general exams, and I took mine this May along with eight other graduate student. Five men passed, which means that they are full-fledged Ph.D. candidates. Their course work is done, and they go on to their research and dissertation. The four women failed. My case was the worst. I was asked to accept a master's and leave. But there's another level between a master's and passing—what happens is the professors believe that you can probably do it, but that this time you didn't perform successfully taking generals. So, the three other women have been asked to retake the examinations—two of them in October and one in January. I do believe there's an injustice being done here; it's not a coincidence.

In the generals per se, I don't feel any injustice in my own case. My background was weak, and the exams were very hard for me. I'm very content with my situation. But I was in classes with the other three women. One of them was in almost all of my classes, and she just seemed so sharp. She helped me a lot, and there didn't seem to be a whole lot that she didn't know how to do. One of the other two women was attending meetings with her adviser and almost has a paper written.

[The general exams affect you] tremendously. You are a second-class citizen in the graduate world before you pass your generals. People act like they are not sure if you really belong here until you pass them. If you don't pass the second time [you take generals], you're asked to leave; it has a great deal to do with confidence. [For myself,] I've always wanted to teach. I thought I was going to teach at the college level, but the more I think about it, I want to be more of a role model and a teacher. So, now that I have the master's, it's the perfect opportunity to teach at the high school level, but before I secure such a job, I would also like to look into what opportunities I have in industry. I know that an analytical mind is of value out there, and I know that I'm good at things, even though Princeton doesn't make me feel that way. So I'm just going to go out there and be happy. I'm happy to finish my schooling; I never took a break.

As far as experiences here, during my first year I was engaged, so I was single and lived at Princeton. It was hard because on the weekends we visited each other, even if I had a lot of schoolwork. The schoolwork was hard to fit in; it had to be done, though. Then, we got married, and this whole second year we've been living together, so I've had a support system that I didn't have last year living alone. When I came through the door at five or six o'clock, there was someone there to tell me, "You're not as bad as they make you feel. You know you're worth it. Keep going."

He's an electrical engineer and he's very happy and in a lucrative job. So, his side of the family is set. Thank God for that, because right now I'm still trying to make everything pan out. We can depend on him. He just says, "I don't care what you do as long as you're happy," so there's no restriction on me from his side.

I think being a TA here was one of my best experiences. Last fall, I was a TA for the first time in Civ 201, a programming course. Civ 201 has a reputation among all the graduate students of having a ton of work, because not only do you have to grade papers, but you also have to lecture once or twice a week.

Giving lectures to the undergrads was just a wonderful experience. I also felt that they got a lot out of my lectures, which was really rewarding. This past semester I TAed, but only for half of the semester because of my general exams. You're not supposed to TA the semester of your generals, but they really needed the help.

One day I was sitting in the course with all the undergrads, and the professor asked a question that was supposed to have an obvious answer, and we were required to either nod our heads or shake our heads. I did the wrong one, and as a graduate student preparing for generals, I should have known better. The professor pointed at me. He stopped his lecture and said, "You should have known better." Well, I walked away from that class feeling down because five minutes later I leaned over to one of the undergraduate men next to me and asked him to repeat the question; I had heard the question wrong.

Two days later I went to the professor's office and said, "I just want you to know something. I didn't like what you did to me. It felt terrible. I don't think you should do that. I'm not stupid, and I don't think I should be treated like I'm stupid." He said, "Ah, Pam, you know, I was thinking about that after class, and I shouldn't have done that to you. I'm really sorry."

If I hadn't gone to his office, he wouldn't have come to me and apologized. I would have walked around feeling like an idiot. I told him, "You know, I didn't hear your question correctly." He said, "Oh, well I'm glad to hear that, because it was kind of a basic question."

In general, being a TA has been a really good experience, especially the actual teaching. One day I was teaching an exceptionally hard lab. I had spent a lot of time preparing my lecture so that it wouldn't seem any more complicated than necessary. When I was done lecturing, about five people out of 13 walked out of the classroom and said, "Ah, thanks, that was really good." It just made my day. I don't get pats on the back from the professors, so it's great that I got them from the undergrads.

In February, I hit upon this discovery of a new way of looking at a graph we were dealing with . . . In my research, it was a big breakthrough. You could write good papers about this, but my adviser proceeded to say, "I know you're having a tough time right now, so put it aside. This is good work. Go study for generals. When generals are over, this is what we'll pick up and get done." That was a good day.

On the bad days, I pray a lot. I have a deep faith in God. I'm a Roman Catholic and quite often I just walk over to the chapel at noontime and attend a 20 or 25 minute mass, just to sit and pull the day back into perspective. After a morning of feeling like an idiot, I put my identity back where it belongs and go back to survive the afternoon. Another thing [that helps] is the people who love me. I write electronic mail and make phone calls to my husband. In the evenings I talk to my parents and my sisters. I just need the support and affirmation of people who aren't here, who know me as a person and not as a student.

I went to other women graduate students and asked them if they were experiencing similar things. What really helped me are the luncheons we've had. We bring our lunches and sit around talking. It was the best feeling to know that, "Gee, I'm not the only one." For a year I thought that I was the only one because the other woman in my program seemed to be soaring. We had nothing in common academically. She always helped me learn what I didn't know, and I thought I was the only dummy. But I'm not a dummy, it just took me longer to learn things because my background was weak.

I feel committed to helping other women so that this doesn't happen to them. I want to teach women math, because I think women learn differently from men; I didn't learn well when I was taught by men, and I think it would help if women were taught by women because their minds have more in common.

[Dealing with sexism] has to start at the individual professor level. You can't train 50- and 60-year-old professors who have grown up in a chauvinistic world to be sensitive to women's issues overnight, but that's the ideal. The ideal would be for every professor to have gone through some sort of formal training to be very sensitive to women's needs, which are different from men's needs: Not treating women differently in such a way that they feel like outcasts, but just being sensitive, but I don't know all the solutions. Nassau Hall could mandate an organization of women's meetings to support one another. I think there should be academic ways that we can get together and help each other without a sense of competition; this place is very competitive.

Nassau Hall seems so blind to what's going on. They're going to look at the statistics for last week's generals and say, "Oh, gee, the men passed and the women failed." Then they're going to ask the head of the department for a reason, and he's going to say, "Oh, well, the women didn't have as good backgrounds when they came here," and the case will be closed. People need to look at this and say, "Hmm, this needs looking into."

Another suggestion is that every woman graduate student should be given an exit interview [when she leaves the University], whether or not she got the degree she sought at the beginning. And after a number of these interviews, the interviewer should start to assemble the right questions to ask in order to see exactly what is going on here. This would make one big pool of [what are considered] isolated vignettes of experience; [alone,] they mean nothing, but

when you pull them all together, they mean a lot. I'm going to make my own appointment for exit interviews in several different offices—academic, student life—I want my voice to be heard. I want to do anything I can to help the people who come after me.

Quite often [women in the department] are asked to leave. In the last 10 months two women have left who were second year-students, and now the only ones who remain failed generals. They look at this and say it's a coincidence. Not true. I'm not trying to point a finger at any individual, and most professors are so good-natured. These things are so subtle that they're hard to explain.

A professor should talk to female graduate students on a level of respect. If her goals are different than his, which is quite probable, he should respect that. If she says that, in the end, she wants to teach part-time and mother part-time, he may not see that as a high goal in his mind where 24 hours a day is the end-all and be-all of life. This isn't just a woman's issue; he needs to be able to ask his graduate students what they want out of this, male or female, and help them direct their work toward their goals: [It's not that] all the men are ecstatically happy while the women suffer.

[Sometimes professors] goof up and say [patronizing] things, but these two years have certainly opened my eyes. I'm a better person in so many ways. I think I can help so many more people than I could have with my eyes closed two years ago.

I've learned a lot these past two years. It's been a wonderful experience to look back on, but it was a struggle. Up through when I graduated from college, I didn't know what it was like to not do well academically. A's didn't always come easily, but if I wanted an A, I got an A. I knew what to do and I did it. Then I came here and gave it my all; I put in overtime; I gave it everything, and I still got a C, which is a failing grade [in grad school], or a B. I think that if I'm going to be a teacher, I need to have that experience. I couldn't have been a teacher two years ago; I didn't understand how people don't do well, how people struggle. In college, I never understood how the girl next to me could work so hard and get such bad grades. I thought she just must not be working hard. I really didn't know what it was like, and I think it is a really wonderful thing to add to my knowledge. It's not head knowledge; it's heart knowledge.

What does not destroy me makes me stronger.

—Friedrich Nietzsche

After Princeton: Life Outside the Bubble

I like the dreams of the future better than the history of the past.
—Thomas Jefferson

WHAT ARE THE DREAMS OF LIFE AFTER GRADUATION AND HOW DO THEY MEASURE UP TO REALITY? HERE, CURRENT AND GRADUATING STUDENTS SHARE THEIR ASPIRATIONS FOR THEIR FUTURE PROFESSIONAL AND PERSONAL LIVES. SEVERAL CONSIDER WHAT BALANCE THEY WANT TO STRIKE BETWEEN WORK AND HOME. ALUMNAE REFLECT ON THE GOALS THEY HAD AS UNDERGRADUATES AND THE NATURE OF THEIR CURRENT CAREERS AND LIVES. THEY INDICATE HOW A PRINCETON EDUCATION HAS SERVED (AND CONTINUES TO SERVE) THEM AND HOW THEIR UNDERGRADUATE EDUCATION WAS, IN SOME WAYS, INCOMPLETE.

The Published Record . . .

From "Women in Engineering," *Princeton Engineer*, Spring 1976, p. 12–13

Princeton has graduated a grand total of four women from the engineering school:

Kit Meyers '73 AMS; Pat Kuntz '74 AMS; Heidi Bode '75 ChE [Chemical Engineering]; and Angela Del Greco '75 ChE. This number will more than triple this June with the graduation of nine women engineers.

When speaking about their experiences after leaving Princeton, these women have both good news and bad news to report. The good news—a Princeton engineering education is excellent preparation for engineering employment or graduate study. The bad news—expect to be in a very small minority and to experience some negative attitudes.

Angela Del Greco is a process engineer for the engineering services division of Proctor and Gamble in Cincinnati, Ohio. Her job is to design new chemical plant systems. Since her division is responsible for designing and maintaining service systems for all the company's various plants, she is on the road at least once a week.

To Angela, the biggest shock of stepping into industry was the lack of problem definition. In school, one is taught how to approach problems which are

well-defined and whose solutions involve grinding through long, complicated equations. In industry, problems are ill-defined and nebulous. One must sort through mounds of data to find the relevant pieces. Angela found her courses to be of no help in learning to define problems, whereas her thesis work did.

At Princeton, Angela saw no need for the Society of Women Engineers. "I didn't see any discrimination. The professors and my peers had fantastic attitudes." Now, she knows sexual discrimination is very real. "I've become a little cynical and disillusioned. Subtle, but cut-throat policies go on. I feel the hostility." As one of 12 women in a division of 1250 men, "the biggest shock was realizing I have to prove myself more than the men just to be accepted." Surprisingly, Angela reports, "Men in my age group are the toughest to work with. They don't cooperate due to the competition of being on the same career path. It's easier to work with older men you're not competing with. The best age bracket is 30 to 35. They often have wives who are working and so can sympathize with us. Men over 50 don't even feel we should be here at all." She concludes that "women have a long way to go."

Heidi Bode is a researcher for a New Jersey chemical company. Currently she is working on developing a blend of polymers to be used in a front bumper energy absorber for automobiles. She would like to stay in a technical field, but not pure research; she mentioned wanting to get into marketing. When queried, Heidi agreed with her classmate, Angela: Princeton prepares you well for engineering employment. "I'm glad I went to Princeton."

As one of two women on an engineering staff of approximately 200, she hedged on the issue of discrimination. Many attitudes could be because "it is a conservative company. The average age is 45. They are not used to young people. In some ways there is sexual discrimination, but it's hard to pinpoint."

Pat Kuntz is in her second year of graduate school at Stanford University. Having received her master's in '75, she is continuing towards her Ph.D. in mechanical engineering. Working in the High-Temperature Gas Dynamics Laboratory, her thesis research is in spectral techniques.

She enjoys research and may continue it after graduation whether in government, industry, or academia. Making it unanimous, Pat calls Princeton an excellent undergraduate school: "it's good preparation for graduate school." Pat keeps in touch with her alma mater as a member of the Advisory Committee for the engineering school.

Women are as scarce at graduate school as when Pat became Princeton's first female B.S.E. candidate. "There is only one other woman mechanical engineering grad student. However, in a chemical engineering course I'm taking, there is a female grader." She complains about the difficulty in meeting and getting to know other women, adding that she misses all the great women at Princeton.

Regarding any discrimination, she hasn't noticed any serious negative attitudes. However, being the only female in her classes is a fact she and her professors are well aware of. Yet she says, "Once you get involved in a small research group, you become an individual."

. . . Personal Voices

Nancy H. Lin '77, Chemical Engineering

For engineering students, social interaction often occurs in an academic environment, especially working on problem sets. Engineers can share comparable experiences and speak the same language.

My husband also went to Princeton in chemical engineering. Since engineering is an important part of our lives, it is nice to be able to share it. When my husband was in graduate school, sometimes we would go out to eat with some of his classmates. I was the first woman many knew who could "speak the language" and talk about their work.

I have been working at Mobil since graduation, moving back and forth between the research and business areas. With a big company, you can have flexibility without having to change companies. I've cost estimated processes, scheduled crude oil tankers and refinery runs, and traded crude oil futures. Working in the oil industry, a chemical engineering degree is a distinct advantage; you have more credibility.

I sometimes think that there is a certain amount of testing of women engineers. You need to prove that you're not a quota. It's nice when you convince someone that you're good at what you do. Once, in a speech at a retirement party, one of my managers said, "I just want to tell the vice presidents that Nancy may be only four feet tall, but as an engineer, she's over six feet."

At Mobil my opportunities have never been limited because of my gender. I have two daughters, one is almost three, the other is just a few months old. I took off eight weeks for the first child, and six weeks for the second. During my first pregnancy, I was working and trying to wrap up my thesis for my M.B.A. I really wanted to get it done before having the baby. In fact, I dictated the abstract of my thesis to my husband from my hospital bed, just before giving birth. He's always been very supportive.

You really have to love your work. I've heard that a woman is more likely to quit her job after the second pregnancy than after the first one. With two children, all the slack is gone. You can feel run down, out of control. You need day-care you can trust, and a sense that your having a career is a long-term benefit to the family. After having the second child, having supportive and flexible management becomes crucial. You still have to pull your weight.

I think that chemical engineering is one of the best fields. It does not limit your options; you can go just about anywhere. I would like to see my daughters study chemical engineering as undergraduates, but I'm not sure I would want them to become practicing engineers. I don't think the corporate world values engineers as much as it should; business too heavily values and rewards the legal and financial fields. All in all, though, I am very happy with my career and what I have accomplished—and I'm only a third of the way through.

Molly Follette Story '78, Civil Engineering

As graduation approached, I began interviewing. I considered working for Bechtel, until I realized how much work they did in the Middle East and how much my professional life would be limited in such countries because I was female. I decided to seek employment in a small company, probably a structural engineering consulting firm.

One day, my thesis adviser told me that a small consulting firm in Denver was looking for an entry-level engineer, and I was the only one of his students who wanted to do straight structural engineering. I think it made him uncomfortable because I was female, and he was uncomfortable with women engineers. But at least he told me about the job opening. I interviewed with them and received an offer, but decided to return to my home in the San Francisco Bay area.

I interviewed with several companies in San Francisco, and took a job with GFDS Engineers, where I stayed for two years. The partner who hired me had gone to Princeton himself and knew my thesis adviser.

GFDS Engineers was a firm with six partners and two other engineers, plus me. I was the first woman they had hired full-time (they had had one female student work for them the previous summer), and they didn't know exactly how to handle me. They were very paternal. I went in as a well-educated but professionally untrained engineer. They were patient and effective at training me to do the job; however, they never took me to construction sites. At the time I was timid and not fully aware of what I was missing; I now know how seriously it hurt my professional capabilities not to see how things were actually built. Today, I would never let that happen, and maybe I would still be working for them.

After two years, I had mastered the practice of structural engineering and had doubled my salary. The company had hired two additional engineers, one of them female. I began to look around for the other career possibilities. I wanted to design *things*, but I didn't know what that field was called. To make a long story short, I discovered a program at Stanford in product design, jointly sponsored by the departments of Mechanical Engineering and Art. I entered that fall.

Graduate school was a wild and wonderful time for me. I thoroughly enjoyed product design and the people in it. The department awoke some creative corners of my soul which had been suffocated at Princeton.

There were still not very many women in the field, especially with engineering bachelor's degrees, but more than there had been in my classes at Princeton. There also was a greater need for women, because half of all product users are female, even though only a small proportion of designers are. My master's project was the design (and construction) of a set of birthing furniture for use in the hospital. This was one product that needed some female design input! It was made to support both the mother and her partner during labor and delivery at the same eye level as any standing birth attendants, and allowed a variety of birthing positions. It was soft and warm and friendly without looking like it belonged in someone's living room and without compromising the needs of the medical professionals involved.

Since receiving my master's degree, I have worked some for Raychem Corporation in Menlo Park, California, as a new product inventor and developer, and I taught part-time for six years in the Industrial Design Department at the Georgia Institute of Technology (Georgia Tech) in Atlanta, Georgia, where I now live.

I have a husband who travels a lot, a 3-year-old daughter, a 14-year-old stepson, and a 19-year-old stepson who is a sophomore at Baylor University. I quit my teaching job in June, when the 14-year-old came to live with us, and I have called this year my "maternal sabbatical." I found it too stressful to try to "do it all," at least until I establish a routine to handle the complications of a family like mine. I look forward to returning to part-time work very soon though, because I miss the creative challenges and rewards of my work.

I continue to encounter resistance to my being female in a mostly male profession, but it's a pressure I have learned to handle, if not enjoy. I take pleasure in proving myself to be very capable, and making believers out of skeptics. As I suspected it would, age has helped my credibility and my confidence level. I have proven to myself as well as others that I can do this job and do it well, and being a woman is often an advantage. My next professional experiences will probably involve designing for the elderly, a group that is predominantly female; they deserve to work with a designer who can relate to their problems.

Laura Pope Pavlovich '83, Chemical Engineering

Submission to* Women Reflect About Princeton (WRAP), *with postscript, printed with author's permission.

A Diary of a Young Mother

April 12, 1985: Promotion— Bill Werther ('81) approached me today about coming to work for him developing a new product. If that isn't the old boy network at work—he was in Cottage Club with (my husband) Robert. I met him there a few times, and he interviewed me on campus to come work at P—. In the year-and-an-half that I've been at P— he's kept an eye out for me, even though we work in different departments. Now that he's starting his own project, he's selected me and another Princetonian, Pierre Muri GS, to work for him. Rushed home to tell Robert the good news.

May 12, 1985: Morning Sickness—Had to run out of church in the middle of the sermon. H— heard me being sick and was the first to congratulate us on our pending arrival.

May 13, 1985: Chemical Exposure—Work was horrible today. I don't want to tell Bill my exciting news, because I'm afraid he'll take me off the project. Spent the whole day up on top of the carbon tanks in the methylene chloride room. The room was ventilated and all the equipment was off, but I still smelled residual methylene chloride (dichloromethane) vapors. I'm terrified, because I know that exposure to halogenated hydrocarbons in the first trimester can cause abnormalities

in organogenesis of the fetus. I'm taking every precaution—good ventilation and frequent breaks—but I really don't know what harm I may be doing.

May 28, 1985: Tired— L— caught me napping in the ladies room during lunch hour; now she knows I'm pregnant. I've been so *tired*—I fall asleep at lunch every day. The doctor says the fatigue should ease up after the first trimester.

At Princeton I never would have allowed myself the luxury of midday napping, but this is no luxury—I cannot stay awake. I just cannot expect the same performance from my body that I could before.

May 29, 1985: Still Tired—Went to New York Public Library to do background research for a project. Fell asleep at the reading table.

I am angry with myself for letting this pregnancy interfere with my work. In "Sociology of the Family" at Princeton we discussed juggling career and family as though having kids was a minor extracurricular activity. I had no idea it would be so physically demanding. Nothing I learned at Princeton prepared me for this.

June 16, 1985: Morning Sickness—Woke up at 6:00 a.m. Robert drove me to the airport. I got sick in the car—luckily I had a plastic bag in my briefcase. Caught the 7:00 a.m. Boston shuttle. Threw up four more times in the cab on the way to the conference center—the poor driver was upset. Went to the ladies room and cleaned myself up so I'd be ready for the first seminar at 8:30 a.m. Flight home was much better.

July 5, 1985: Travel—Bill told me today that I'm going to Boulder, Colorado, to evaluate a potential process for manufacturing our new product. Intellectually, I'm excited, but I'm nervous about traveling after my discomfort on the Boston trip. I still haven't told Bill that I'm pregnant. I'll just take extra precautions against morning sickness and fatigue, and I'll be an intelligent, competent representative of the company.

July 8, 1985: Sick Again—I'm making this entry from my motel room in Boulder. I haven't gotten out of bed in two days, except to run to the bathroom. I'll skip the details—a delayed flight, a full hotel, a night on the couch, a winding mountain drive—that led to this condition. Suffice it to say that I cannot ignore the fact the pregnancy does interfere with my work (or that work interferes with my pregnancy).

July 12, 1985: Warning—Finally made it back to New York. Went to the doctor for my monthly check-up. I've lost seven pounds. She told me to come back in four days, and if I haven't gained two pounds she is going to hospitalize me.

July 13, 1985: More Travel—Bill says the Boulder trip was a success because of the samples I had had made and the extended meetings with the plant manager. He says I'll be leaving for Michigan on Monday to check out another manufacturer. Oh no!

July 14, 1985: Told the Boss—Bill sent me in to the methylene chloride room to draw a sample this morning. I refused to go, because the equipment was running and the atmospheric concentration of methylene chloride was around 1,000 ppm [parts per million] in the room. This was the last straw—I could not keep my secret any longer.

I told Bill I'm pregnant. He didn't say much. His boss said, "I knew this would happen. I had another female engineer protegeé. She got pregnant two years ago, and I haven't seen her since."

The president of the company said, "See, Laura? That's why I don't like to hire women."

Nothing in my four years at Princeton had prepared me for such a negative, anti-female reception. At Princeton, female undergraduates were treated as intellectual equals. Biological differences were ignored. But maybe we had our heads in the sand those days. What does it mean to be a woman? Are we really the same as men? Do we want to be?

July 19, 1985: Slowing Down—Trip to Michigan was successful. Took an extra day to travel so that I could begin my meetings well rested and relaxed. I am learning to make concessions to my body. Is this the same person who used to stay up all night finishing a problem set, drink two cups of coffee, and run down to the lake for an early morning practice? The high-pressure, fast-paced Princeton lifestyle just doesn't mix well with the growing baby's demands on my body.

December 29, 1985: A Babe is Born!—I'm lying here in the birthing room with Elizabeth Pope Pavlovich sprawled across her erstwhile home—now deflated and flaccid. She rouses herself now and again to suckle dreamily at my breast. The thick, white liquid dribbles out the corners of her half-smile.

The delivery was easy. The last few pushes reminded me of a power 10 in the last 500 meters of a crew race on Lake Carnegie when the coxswain is screaming and you just turn off your brain and give it all you have to give.

"Princeton in the nation's service." Bah! Who cares to sit in a steamy room with a brood of greedy, lusty men worrying about the division of the meager riches of this small world, when someone precious cries out with a need that can only be answered by Mother?

January 2, 1986: Nursing—Mom came over today to help out with the baby. She is an "old wife" in the true sense of the words. She arrived at noon and caught me sitting at the table, trying to nurse the baby while eating a sandwich and reading a magazine.

"This isn't college, Missy," she nagged, "where you have to do three things at once just to keep up. You have an important job to do, so let's concentrate on it until you get it right."

She then held the baby and led me to a comfortable seat on the couch. When I was ensconced with pillows and foot stool, she handed back the baby. Elizabeth, sensing my physical and mental tension releasing, lustily got down to the business at hand. When Elizabeth was well under way, Mom served me my sandwich, with a tall drink "for the milk."

Is this why most of my friends abandoned breast feeding after a week? They said they had "no milk," or "the milk dried up," or "the baby was starving." Your body cannot metabolize a tuna fish sandwich and lemonade into breast milk if you are making it wrestle with tigers. Even if the milk is produced, it will not flow

until you and the baby are relaxed and ready.

Everything I learned at Princeton went against this. I had to unlearn four years of behavior modification to learn to be relaxed and receptive and ready.

March 29, 1986: Back to Work—After three months at home, I returned to work today. Robert brought the baby down at noon and I nursed her in my office.

October 20, 1986: Working Harder—Work is frustrating. I'm averaging about 15 hours per week; which is not enough time to accomplish the kind of goals I set for myself. I'm feeling healthy and strong, and Elizabeth is getting quite independent. I think I'll increase my work schedule.

January 10, 1987: Sick—Feeling very run down lately. I also feel nauseous. I hope I don't have the flu that's going around. I get very tired and irritable when I'm hungry—perhaps I'm hypoglycemic. I have an appointment with an intern tomorrow.

January 11, 1987: Doctor's Visit—How could I be so silly? It took $150 and a barrage of tests to figure out I'm pregnant again. I'm so excited! Robert will be, too, once he gets used to the idea.

February 14, 1987: Tired—Valentine's Day? Hah! Robert and I fight constantly. I'm too tired; there are too many demands on me.

We get up at 6:30 a.m. I rush to get Elizabeth and myself up and dressed while trying not to throw up. I schlep her, her diaper bag, my purse, and my briefcase out to the car, trying not to slip on the ice and kill us both. By the time I've dropped her at the sitter and am at work, I feel like I've put in a full day already.

Four hours drag by, an overcrowded workday further encumbered by the necessity to take extra precautions against chemical exposure. My authority is limited because of my part-time status.

At noon I pick her up. My desire to question the sitter about the minutiae of my daughter's behavior is tempered by my need to get home and get some lunch in my queasy, prenatal stomach.

If all goes well, she falls asleep in the car, and I can transfer her to her crib. Then I eat and fall asleep, too. After our long naps, we barely have time to run an errand, visit playmates, or clean the house before it's time to make our dinner. After Elizabeth is fed and bathed, we play until Robert comes home, and the cook, serve, clean-up cycle starts all over again.

When Elizabeth has calmed down from the excitement of Big Daddy coming home I wrestle her into bed. I often fall asleep in the rocking chair with her. If I do stay awake it is only to nag Robert about working so late and fight about the housework. Is this double-income yuppie bliss? Is this what I went to Princeton for? It is hell to me, and I won't take it anymore.

April 15, 1987: Quitting Time—Today was my last day of work. I gave them a month's notice and tried to document all my projects. I feel the tension easing already—inside myself, between Elizabeth and me, and, most importantly, in our marriage.

Three unrelated factors led me to leave my job. I'm increasingly concerned about chemical exposure. There have been three serious accidents during the last year, and when I am pregnant there is a lot more than my own health at stake. In addition, I am frustrated trying to do a thorough, professional engineering job on a part-time basis. I have too much pride to do a slipshod job. Most importantly, I'm just too darn tired. I cannot schlep a toddler back and forth, take care of the household, and be a good engineer—all while growing a new baby inside me. I don't have the energy. I don't have the strength. This was the hardest decision for me—a Princeton alumna—to make.

Am I succumbing to the biological demands of womanhood? Am I ditching my career behind a vague entity called "family"? Are women really the weaker sex?

No. I'm taking life's opportunities one at a time. I have my whole life ahead of me for a career in chemical engineering. I can only grow this baby this year, and I can only nurse it next year. Later, when my unique biological functions are no longer called for, I can continue in the field I chose at Princeton. But that can wait.

May 18, 1987: WRAP—Got a letter today from a new on-campus group called Women Reflect About Princeton. Sounds interesting. But what could I, a suburban housewife who has thrown away her career to raise children, have to say to a group of Princeton women? I would write about how much I enjoy mothering. It is a shame that in striving toward intellectual competitive equality of the sexes, the Princeton experience belittles the special biological functions of women. I would write that Princeton women need a definition of femininity that gives them credit for non-male activities; we are not men's equal if we think we have to be men.

Postscript to WRAP article (December 1991)

There is a whole spectrum of human characteristics—meek to aggressive, literary to scientific, cautious to careless, that are common to both men and women. I have found, however, that the stereotypes do hold true to a certain extent. Many women are more verbal. Many men are more aggressive. As an industrial engineer in a manufacturing facility I would have been more successful if I were aggressive and strong and handy with tools. Having an excellent book-knowledge of engineering was not enough. Princeton did not and could not prepare me for that blow.

On campus, I did not feel principally a woman or an engineer; I felt like a Princetonian. I was a marginal member of SWE and AIChE. I was involved in crew, theater, singing, Elm Club, being an RA, and working off-campus for Recording for the Blind. I enjoyed socializing with my friends. I took courses like Chaucer, Roots of Western Literature, and two years of German. I took them as seriously as my engineering courses, much to the chagrin of my thesis adviser. My only regret—that I never took a course with Joyce Carol Oates. (Professor Oates, if you are reading this, can I still get a chance to meet you and talk with you?)

I liked the human side of engineering. I loved Professor Johnson's Process Control lectures which he peppered with quotes from the Latin classics. My pre-

med roommate and I used to read double entendres into some choice passages in *Fluid Mechanics.* I loved the freshman lecturer who dramatized physics with his sexy French accent, "I take my frame of reference wiz me wherever I go…" There were different sides to engineering, from the human to the abstract.

Would you believe I am a writer now? I have WRAP to thank for getting me started. Once I saw my words in print, I had the bug. I have been published in *Quality Assurance Bulletin* and been rejected by many prestigious magazines. I only work from 9:00 a.m. to noon while both kids are in school. I am not rich and famous yet, but at least *QA Bulletin* pays better than these Princeton memory books.

Shara Lewis '85, Civil Engineering/Architecture

My extra curricular activities were gymnastics for the first year and a half. Later I did Peer-to-Peer counseling and led a women's support group for women with eating disorders. I also served as a student liaison to the faculty in the architecture school. My engineering classes were not social, and that's probably why my extra curriculars were people-oriented and why my friends were such a significant part of my life. I felt as though I had to break out of the stereotypes of engineers.

I got used to having only one or two females in a class of 60. I am the only daughter in my family, and I've always had many close male friends so [the ratio] didn't bother me. Often I didn't notice the gender ratio until someone mentioned it.

My first job after graduation was a summer job as a science radio reporter. When the summer ended, I had a real choice to make: Do I take an engineering job I had lined up or stay in the radio business? I chose the engineering job, but I was not happy there.

I was definitely *not* prepared for the working world, even with my qualifications. In my first job, I was put in the front of the office where a receptionist might be seated, and I was always interrupted by visitors. It was a very chauvinistic environment and no one had pride in their work. They punched in at 8:00 a.m. and punched out at 4:00 p.m. Nine months later I left. It was kind of rough since my professor had helped me get the job, but it was not a good match. For the next two years I worked for an entrepreneurial real estate developer, supervising construction.

For the last two years, I have worked for a construction management firm. It's a balance of architecture, construction, and business in which I use little more than the basics of civil engineering. I literally "fell into" the job. Engineering design was not for me: I can't sit at a desk all day. With my training, I had the option of going into architecture but I'm glad that I stayed with the more technical aspect.

The construction world is a male one. The fact that I'm a woman is a novelty, and everyone notices it. Comments like "There's a woman running the job on 50th Street" are not uncommon, but I've learned to balance being feminine with being tough.

In construction, women engineers are more respected than nonengineers, and saying that you have an engineering degree from Princeton impresses people. But the bottom line is what you know, not where you studied.

Maybe if I had been more involved in SWE, I could have been more prepared. I shied away from women's studies because I didn't want special treatment. Yet, now that I'm in the working world, I see the need for some attention to the issue so I'm on the Board of Directors for the National Association of Women in Construction. I didn't want to see quotas, but I found that women get lower salaries. I don't want to be hired because I'm a woman, I just want to because I'm good at what I do; however, I go on job interviews and when they find out that I'm married, the interviewer assumes that I'm not the breadwinner and that he can pay me less.

What's the answer? More women professors to look to as role models or to have opportunities for informal talks? SWE-sponsored professional talks? My role model was my godmother. She was really supportive, feminine, but very technical.

Francesca Rago '85, Civil Engineering and Operations Research

I applied to Princeton as a liberal arts major. The summer before my freshman year, I decided to switch into the engineering school since I liked math and wanted a practical education. The engineering management systems (EMS) program fit my interests best; I liked modeling and optimization—finding the best way to do something. The program emphasized case studies and problem-solving, which allowed me to develop analytical skills for the work world.

Currently I work as an engineering consultant for Booz-Allen and Hamilton. My job focuses on information management, optimization analysis, and technical decision-making. Much of my work involves consulting for the government.

At Princeton I never felt any sexism. Things were great at Princeton, but in the "real world" sexism is rampant. Recently I have been working on a State Department embassy design project that combines many engineering disciplines. The government intelligence group consists largely of older, more conservative men. At a meeting with the clients, an electrical engineer on the project asked me to go do some photocopying. I couldn't say much about it at a meeting with clients. His automatic assumption that I would take care of the photocopying bothered me, so after the meeting I informed him that I am not the "group copier."

It was also assumed that I would perform most of the note-taking at meetings. This ended up being a good thing, though, in a way. Documenting viewpoints and required actions is a deceptively simple method of facilitating decision-making and, in a sense, of gaining access to and control of information. Thus, it is fortunate that engineering education at Princeton put such an emphasis on writing; it has helped me a great deal in my job. The EMS program helped me develop a persuasive and concise writing style. Professor Kornhauser was particularly good; he emphasized incorporating graphics and text in putting together a complete presentation. My engineering education gave me a marketable background for my work at Booz-Allen.

Ironically, some of the sexism at work comes from other women. A few of the secretaries don't like to take messages for me; often the work I give them gets pushed aside. Sometimes my project manager has to talk to the secretaries before they will finish the job.

Jennifer Haskins Shelamer '86, Electrical Engineering

I took mostly signal-processing and systems courses at Princeton. After graduation, I went to work for General Electric Nuclear Energy in San Jose, CA, because of the post-graduate education program they offered. For two years, I rotated jobs every six month and took in-house courses which averaged 20 hours of homework each week in addition to the normal 40 hours of work. The third year, I attended UC Berkeley full time and received my master's in electrical engineering, specializing in control systems. I am currently a program manager for a line of instruments that monitor and control various functions in a nuclear reactor.

I am finding (after three months in this position) that I enjoy dealing with the commercial aspects of this business more than the technical aspects. It's hard to say whether this is because of who I am or because of the nature of the engineering education I received at Princeton and Berkeley. Both schools emphasize theory; while I understand the reasons for this (supposedly once you know the theory, it should be a simple step to apply it), I guess I needed a more practical education.

In my most recent position, I was responsible for some radio-frequency circuits, and technically, I was totally lost. My foundation in analog electronics, particularly in design, is very weak. While this may partially have to do with my individual strengths and weaknesses and the fact that I emphasized systems work in my studies, I do feel that it is a weakness of the Princeton engineering education. Professor Liu asked our class in our senior year if we knew how to design an RC filter (a basic electrical circuit). Fewer than 10 percent of the class raised their hands. He was shocked. I wasn't. I left Princeton without any design experience at all, especially in the analog area.

One story will illustrate this point. In the summer between my junior and senior years, I worked at RCA David Sarnoff Research Labs. Another engineer asked me to design a voltage regulator (another simple circuit). I really had no idea how to do it, but I pulled out my books and copied something that I thought might work. He sent me to the stock room to get the parts I needed for the circuit, and I was overwhelmed by the selection of resistors. I grabbed some that looked like the ones we used in lab at school. When he saw these resistors, he laughed and explained to me that if I used those resistors in my circuit, they would quickly be destroyed. It had never been explained to me that resistors have different wattages and have to be chosen with circuit parameters such as current and voltage in mind.

This lack of practical experience is probably worse for women engineers than for men. I found that many of the men in my classes had played with circuits while growing up. They had been encouraged to "fix" things around the house, and they had learned many of the basics from fathers, older brothers, or friends while fixing appliances and cars. Women usually are not encouraged to fix things while growing up; this difference does not show up on problem sets or tests, but rather out in the real world. I have found in my jobs that if the problem involves math or computers, I am fine, and I can quickly pick up on whatever is necessary to solve the problem; however, if something has to be designed or built, I am at a disadvantage with respect to men.

When I graduated, I was totally burned out, and while I wanted to go to grad school, I didn't feel that I could face it right away. The GE Edison Engineering Program was, for me, the ideal way to go to grad school: I worked two years before I went to school, and I went to school full-time while GE paid my salary. It's a pretty good deal. Academically, though, Berkeley reinforced the Princeton experience: I learned more and more math, and I still can't design anything. I may never use anything that I learned at Berkeley, because as far as I can tell, few people outside of the academic world actually use that stuff.

Anyway, I'm happy as a program manager. The liberal arts education I received at Princeton (and that, by the way, is why I chose Princeton over MIT) has really been valuable. The ability to communicate is critical to my job, and that ability was honed at Princeton.

Mindy Niedzielka '91, Mechanical and Aerospace Engineering

Of all the benefits of being an engineer at Princeton, I believe the most valuable is my growing awareness of the doors open to me in the future. Interestingly enough, as I look back on what has influenced me during my four years here, I realize that my fellow engineering and science students—my friends—have had a tremendous impact on me and on my decisions about my future. I have been fortunate enough to spend much of my time at Princeton with truly talented, dedicated, and motivated engineers and scientists of the future, who have convinced me, both intentionally and inadvertently, of the opportunities awaiting me in the future, and of my own potential for making significant contributions to applied science and engineering.

This is significant because, outside of an academic environment, such as that at Princeton—which is literally swarming with exceptional students, and without the support and encouragement I have received from some of them, I would never have had the courage to look beyond a bachelor's degree in engineering to the possibility of earning a Ph.D. Living and working with Princeton engineering students has shown me that my success in high school need not be the high point of my academic career!

I realize that Princeton engineering students are a special people who have been given the opportunity to learn and experience a tremendous amount in four years; they are being prepared to accomplish great things in the future. The goals

and ambitions of many of my engineering friends demonstrate to me their awareness of this, and I too, finally, have begun to acknowledge my place among these special students. I am once again formulating academic goals for myself, something I stopped doing—out of fear of failure, not laziness—after I graduated from high school. My increasing self-confidence stems from my classmates' apparent inability to treat me as anything but an equal, their respect of me, and support in general. Furthermore, I cannot think of a single instance of sexist treatment by my peers. Although my sex differentiates me from the majority of engineering students, I do not feel that I have ever been judged, or my academic performance has ever been presumed, on the basis of my sex.

Whether or not I would have needed such strong peer influences to realize my academic potential had I been a male is not clear to me; regardless, the doors are now, finally, open, and I am able to make decisions about my future with an open mind and few reservations.

Amy Fronduti '92, Mechanical and Aerospace Engineering

I've been taking a lot of courses with the view of going to med school, which is something I wanted to do a while back. I had decided to go into engineering, but now I'm thinking about med school again. I'm not sure about the time commitment. If I stay in engineering, I would almost definitely end up teaching in some capacity because I've discovered that I'm very much a people person. I'm not very happy spending long hours in a lab, and prefer dealing with people. I think that being a professor would be a better way to do that, but I'm not sure.

I've also given some thought to simply teaching high school physics or something like that because we need good high school science teachers. One thing I am pretty sure of is that I would eventually like to have a family. I've been thinking a lot about how to factor that into career plans. It's really important for me to spend time at home with a family. During the couple of years before my kids go to school, I would not want to work. That I think is the one thing that makes it difficult to be a woman and work. This time [with my children] is important to me; it's not being forced on me by society. It's just important to me, and I don't know how I'm going to work it.

Susan Kim '92, Electrical Engineering

My dad's a professor so all I've ever seen is the academics. Ph.D., my parents whispered from the day I was born—subliminal hints like "Goodnight, Dr. Kim." I've been so ingrained in that that I don't know what industry would be like. I don't know what else I would do. It's a hard call whether or not I'll stay in engineering.

I don't feel that I'm that good in engineering. When I work on the stuff I like, I'm happy, but I don't think that's necessarily enough. In that case, I should try something else. As soon as I got here, I figured I'd give engineering a chance, but in doing so, I've cut off pretty much all other possibilities. I wasn't paying

much attention [to other options]. I assumed that I'd learn to love engineering, it'd soon be over, and I'd never want to do anything with the rest of my life besides engineering—sort of like an arranged marriage.

I think I'd just like to take a year and read. I haven't read a lot of things I should, and I'd like to have the time to at least skim these things. I'd like to stay in something technical, but I don't know what that'd be.

I'm in a touchy-feely mode since I just discovered that an art history professor I respect very much was originally a physics major who switched to archeology. He's a really cool guy, so I figure maybe I can find something else to be really cool at.

Kathy Prestridge '92, Mechanical and Aerospace Engineering

I had an engineering job. I worked for one engineering firm in which I did design and lab work. I didn't use much of what I learned in school; a lot was learned on the job. When a problem appeared, I had to draw on some of the things I learned [in school], but only about 5 percent. The engineers at work told me that I would use only 10–15 percent of what I learned in school. The rest I'd learn on the job.

My summer experience made me have second thoughts about working in engineering for the rest of my life. I don't think I want to do it now. I'm not sure if all jobs are like it, but it started to become monotonous: "get things done" work.

Also, there was one woman in a group of 50 engineers, and I felt that the atmosphere in the workplace was very male-oriented. It wasn't that I was uncomfortable in that atmosphere, but I felt different. If you walk around dressed in a skirt and stuff, you look like a secretary in a group of engineers. If I was talking with the engineer I was working for, and people came in and thought I was a secretary for the summer, it would have to be explained that I was an engineering student, helping with technical things. People aren't malicious; they don't do those things intentionally. It's just by habit. They don't expect to see women as engineers. But the atmosphere is kind of frustrating, because I feel that there's nothing I can do about it. It's so ingrained in people's minds.

I like the atmosphere here [at Princeton], because there are more women [than at my summer job], even though there are not that many.

I eventually want to get a Ph.D. and be a professor of engineering. I'm not positive about that quite yet, but at least I can start in academia. There aren't any women professors in our department—full, associate, or assistant—and I'd like there to be some. There are women grad students, but only five. It's a shame because the women undergrads don't really have anyone to relate to, to ask about the experience. I don't know what it would be like to be a woman professor. If I can be a professor, I would like to. I know it's very difficult to get tenure, from what I see of the current professors. They work late hours; they have students they're advising, projects that they're in charge of, and research to do. There's so much that they have to do. I don't know what my life will be like if I'll be

married, and how that will affect the rest of my life.

I think that a lot of women think about the question [of balancing family and career]. High school teaching seems a good alternative that many women might pursue. If you're a woman and you don't have tenure yet, you can't really take off time—maternity leave or anything like that.

Teaching math and science in high school is something that is definitely needed. I felt that when teachers in high school looked for the brightest students in math and science, they looked for male students. It was always a surprise when the best student was female. I felt that I had to prove each time—with each new teacher I faced—that I could do it. There is a need for good teaching and a good attitude among teachers as well.

Amy Teske '93, Mechanical and Aerospace Engineering

I want to go work for a company, but I'm not sure what the opportunities are going to be in a couple years. I probably will not go to graduate school, but I may go back later.

I have never worked for an engineering company like McDonnell-Douglas before this summer. Last summer I worked as a secretary/receptionist for a very illogical boss. That experience showed me why I would never want to become a secretary: I would go through the correspondences and correct the grammar, and he would give it back to me with the corrections made incorrectly.

I'm very lucky. I'm going to be working at McDonnell-Douglas this summer, but I was recently offered another opportunity to go to Rockwell International in Alabama. That made me feel better. I've talked to an aerospace senior who said he applied all over the place and didn't get anything. That just scares me to death. But at least, right now, I have something to do.

I've also been raised with a strong sense of family, so that may become important after I finish college. Depending on my future husband's career, and the way my career looks, I may need to follow him and temper my career (as archaic as that sounds). My mother followed my father wherever his job took him. She was a nurse and my father was a doctor so she found jobs in hospitals nearby. She started in administration, got her Ph.D., and changed her career while staying close to home.

Several years ago when she was looking for a job, she was offered several jobs that involved either a lot of travel or moving to another place. Because my father had been working in the hospital for 12 to 14 years, moving to another place was out of the question at that time. Mom didn't want to limit her time with the family so she wouldn't take the travelling jobs. Instead, she started out on a completely different career. Watching her do that, I think I could always find ways in which to keep both a career and a family.

> *The trouble with being in the rat race is that even if you win, you're still a rat.*
>
> —Lily Tomlin

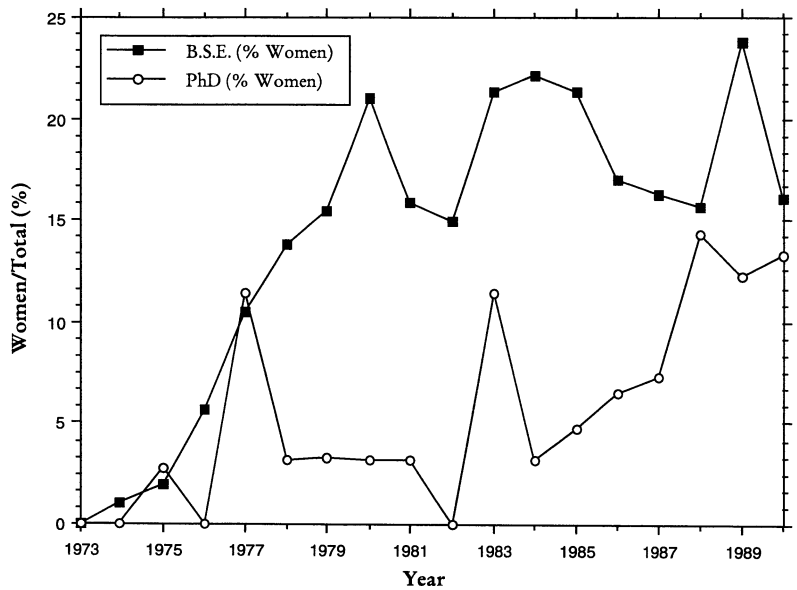
Graphs

In interpreting statistics, it is just as important to ask what is not *being shown as what is.*

—Professor Richard DeVeaux
in CIV 245: Fundamentals of Statistics

THE FOLLOWING CHARTS ILLUSTRATE SOME CHARACTERISTICS OF PRINCETON'S ENGINEERING SCHOOL AND HOW THEY RELATE TO THE POOL OF CONTRIBUTORS.

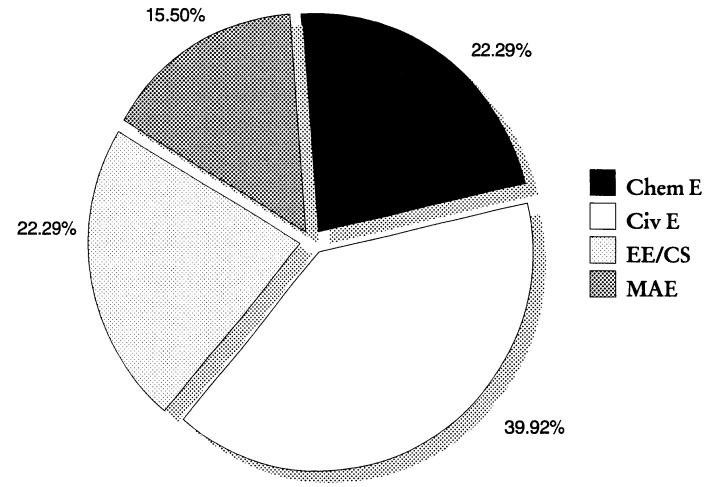
Percentage of Women Earning Engineering Degrees (1973-90)



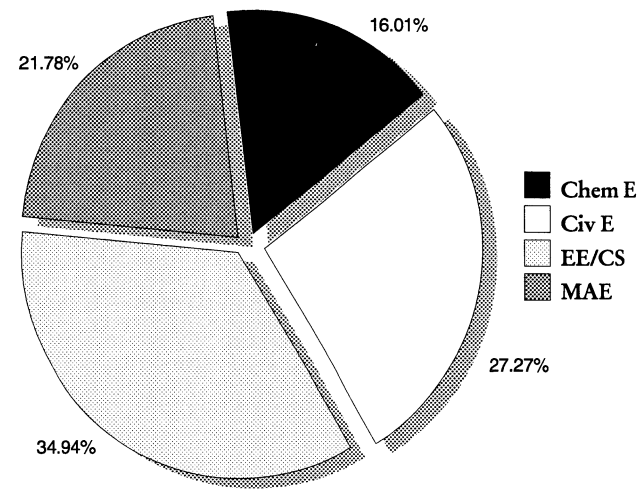
From 1973 to 1990 an average of 171 B.S.E.s and 36 Ph.D.s were awarded each year. The trends in the representation of women at Princeton are consistent with national figures. Princeton has a slightly higher percentage of female engineering undergraduates than the national average (which is currently about 15%); most technical and military schools have a smaller representation. Over the last five to 10 years, the representation of women in undergraduate engineering departments has plateaued, both at Princeton and nationally.

In keeping with national trends, Princeton women constitute a smaller proportion of engineering graduate students, particularly at the Ph.D. level.

Distribution of Women in Engineering Departments (1973–1990)

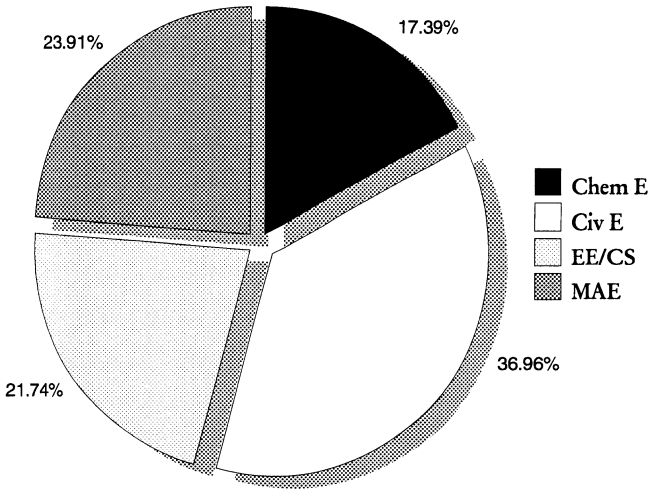


Distribution of Men in Engineering Departments (1973–1990)

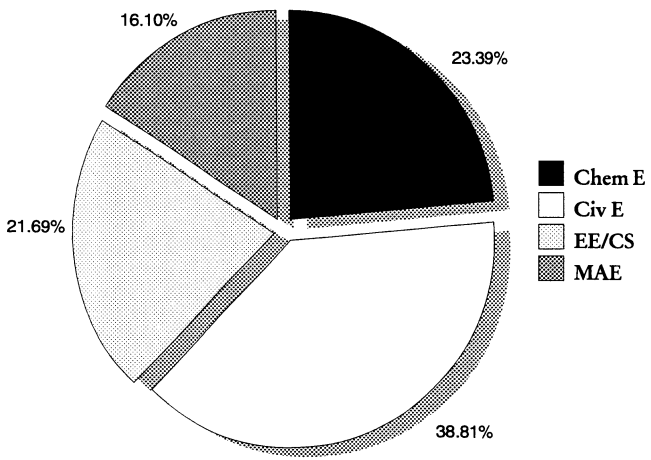


A total of 476 women and 2601 men received B.S.E.s from Princeton from 1973 to 1990.

Contributors, by Department (1973–1993)

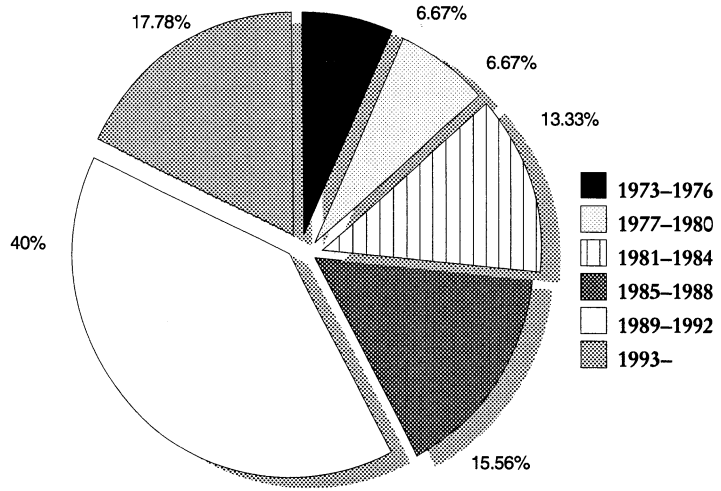


Total Number of Women, by Department (1973–1993)

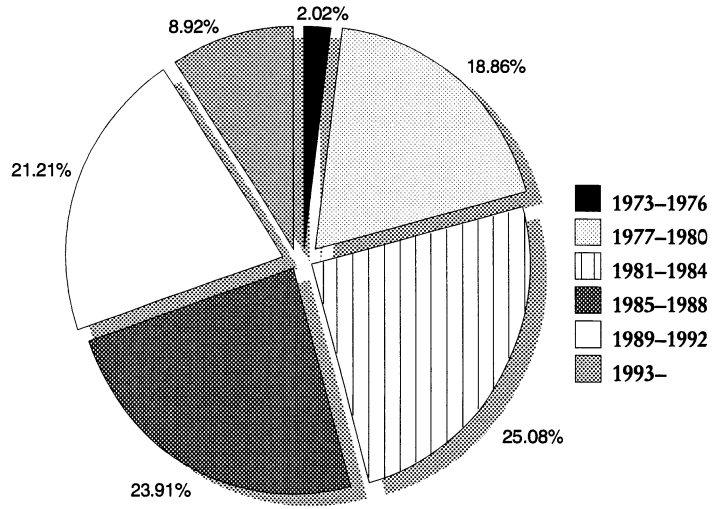


The total number of contributors to this project (excluding the three graduate students and the two A.B. students) was 46. Including the classes of 1991, 1992, and 1993 and the 476 undergraduate alumnae, 594 women were asked to write submissions. Thus, the overall response rate was about 8% for the B.S.E. population. The class of 1994 was not included in these statistics, since these students had not yet declared their departmental majors.

Contributors, by 4-Year Time Blocks (1973–1993)



Total Number of Women, by 4-YearTime Blocks (1973–1993)



The 1991–1993 years constitute more than half of the contributors, probably because these students were on campus during the course of the project. Also, the 1973–1976 years may be "over-represented," since we made a concerted effort to contact these alumnae personally to encourage a submission.

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So what do we know about the difference between male and female minds? Well, long Saturdays hunched over answer sheets seem to turn up evidence that they exist. But what do we know about the nature of origin of those differences—about the likelihood that they spring from biology rather than biography? The short but embarrassing answer, almost nothing at all. Until we raise our seedlings in the same bed, until we offer all young minds the same sunlight and nourishment, we very simply cannot say.

— Beryl Benderly,
The Myth of Two Minds:
What Gender Means and Doesn't Mean

This book is not just about women; it's about engineering—what it is, how it is taught (and learned), how it fits into life (the public and the personal), and what Princeton may or may not have had to do with it.

I became an engineer for two reasons: ignorance and tenacity.

— Jackie Holen '86

I can't remember how many times I heard the comment "Gee, you don't look like an engineer!"—a back-handed compliment, at best.

— Francesca Rago '85

[Some people] crack lame jokes about [engineers], too. They say that I carry a stapler in my bag because "all engineers have staplers in their bags."

— Melissa Tamada '93

I found myself at the boathouse in response to Amy Richlin's quote on the women's crew flyer, "The way I see it, if you liked to do things the easy way, you wouldn't be at Princeton."

— Claire Shortall '76

There . . . was a greater need for women [as engineers], because half of all product users are female, even though only a small proportion of designers are. My masters project was the design (and construction) of a set of birthing furniture . . . This was one product that needed some female design input!

— Molly Follette Story '78