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Persistence Is Cultural: Professional Socialization and the Reproduction of Sex Segregation

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Abstract

Why does sex segregation in professional occupations persist? Arguing that the cultures and practices of professional socialization serve to perpetuate this segregation, the authors examine the case of engineering. Using interview and diary entry data following students from college entry to graduation, the authors show how socialization leads women to develop less confidence that they will "fit" into the culture of engineering. The authors identify three processes that produce these cultural mismatches: orientation to engineering at college entry, initiation rituals in coursework and team projects, and anticipatory socialization during internships and summer jobs. Informal interactions with peers and everyday sexism in teams and internships are particularly salient building blocks of segregation.

Keywords

sex segregation, engineering culture, professional socialization, STEM

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Although the doors to professional occupations were formally opened for women nearly half a century ago, sex segregation in professions persists (England & Li, 2006). Professions like teaching and nursing remain female-dominated and subsequently underpaid and undervalued, while male-dominated professions like science and engineering remain prestigious and highly paid (Cotter, Hermsen, & Vanneman, 2011). Even fields like law and medicine, which have reached gender parity in their incoming cohorts, still have persistent intraprofession sex segregation by specialty area (Heinz, Nelson, Sandefur, & Laumann, 2011; Ku, 2011).

Much social science research has attempted to understand the persistence of this segregation, looking for its roots in institutional-level processes like labor market queuing (Reskin & Roos, 1990), individual-level processes like the gendering of confidence and self-expression (Cech, 2013a; Correll, 2001), and gendered interactional-level issues such as exclusionary or "chilly" climates (e.g., Rosser, 2011; Valian, 1999), tokenism, and homosocial reproduction (Kanter, 1977). While this work has identified important ways in which broad cultural gender biases impact the likelihood that women and men will persist in these fields, much less is known about how beliefs and practices *particular to the culture of each profession* might contribute to patterns of retention and attrition to produce sex segregation. Neophytes are first introduced to this culture via professional socialization—a site where the impact of professional culture on processes of segregation may be particularly pronounced. Broadly, we argue that professional socialization is an important factor in the reproduction of sex segregation within gender-typed professional occupations because it is the formalized process whereby young men and women are first introduced to the beliefs and behaviors of the profession to which they aspire.

Professional socialization entails both mastery of the routine skills and specialized knowledge of the profession as well as a match between personal values and those expressed in the profession's culture (Dimaggio, 1992, p. 127, as cited in Rivera, 2012). A confident professional not only must be secure in his or her expertise to ground discretionary judgments in moments of uncertainty but must also be convinced that he or she embraces the roles, values, and identities that come with the field (Cech, Rubineau, Silbey, & Seron, 2011). In this article, we begin to address the conundrum of continuing gender variation within an increasingly professionalized workforce by focusing on the processes of professional socialization.

The field of engineering is a particularly robust site for understanding gendered processes of professional socialization because it remains the

most gender-segregated field among science, technology, engineering, and math (STEM) occupations at all career stages, from college classes to the workplace itself (National Center for Educational Studies, 2009; National Science Foundation, 2009), representing an outlier case in which it may be easier to observe dynamics that are diluted in more moderate examples (Small, 2009; Van Velsen, 1967/1978). We make use of a unique dataset tracking a cohort of students in engineering at a stage when they have already surpassed gendered assumptions in primary and secondary education about who is good at math and science—an essential prerequisite for success in STEM majors in college (Correll, 2001, 2004; Ma & Johnson, 2008). We follow their experiences across 4 years of engineering education. Pursuing a cultural analysis of professional education, we ask whether phenomena in the rituals of professional socialization and acculturation might help explain why women intend to exit the profession at a higher rate than men.

In the analysis that follows, we revisit traditional conceptions of professional socialization, showing how successful socialization may *simultaneously embrace gender diversity while reproducing sex segregation*. Focusing on the habitus of engineering pedagogy through which "people come to accept and absorb the institutional logics they purportedly enact" (Turco, 2010, p. 6), our data show that men and women succeed equally in the formal, direct, and technical educational experiences. The informal and indirect contexts of required learning in project teams and internships, however, relegate women to traditional gender specific roles and performances. The explicit curriculum brings with it the unanticipated but salient residues of everyday "micro inequities" (Ku, 2011) that raise questions among women about whether they can or want to "fit" into this culture.

We begin by laying out the conceptual framework of cultural analysis guiding our inductive inquiry. In the section following that framing, we describe our methodology, including the use of diaries as a form of qualitative data. We then present our findings organized by the standard events of professional socialization displaying with our respondents' words and accounts how, at each step in the process following entry, engineering education slowly excludes women from full participation.

Bringing Cultural Analysis to the Study of Professional Socialization and Occupational Sex Segregation

Theories of professional socialization argue that the formal and informal experiences of education shape students' orientation toward

professional practice (Becker, Strauss, Hughes, & Greer, 1961; Granfield, 1992; Merton, Reader, & Kendall, 1957; Stover, 1989). Training experiences communicate and inculcate the institutional logics neophytes go on to enact and inhabit as working professionals (Lounsbury, Fisher, Levy, & Welsh, 2009; Schleef, 2006). This homogenizing socialization unfolds as trainees receive, interpret, and experience a profession's culture through the sequenced tasks, trajectories, and spaces of educational training (Elder, 1985, as cited in Abbott, 1997, p. 88). These processes of professional socialization include both direct learning of technical knowledge and skills as well as "indirect learning, in which attitudes, values, and behavior patterns are acquired as by-products of contact with instructors and peers" (Merton et al., 1957, p. 41). The particular sites of this socialization in higher education range from classes to study groups to moments of mentoring and internships; messages or professional signs are also conveyed through the amount and scope of classroom assignments, styles of teaching, curricular priorities, joking and hall talk, class projects, team learning, internships, and summer jobs as well as late night study sessions (cf. Gusterson, 1998).

If professional cultures are systems of circulating messages, signs, and rituals built into and around professional practices and knowledge (Abbott, 1988; Sewell, 1992), socialization is the practice of making familiar to members the communally approved meanings, norms, and practices. For socially competent members, however, the systematicity of culture becomes invisible and tacit, simply known and unproblematic, no longer a matter of explicit articulation or instruction. As teachers and colleagues tell stories and exchange anecdotes from their experiences, they display for would-be professionals and other newcomers "what sorts of practices are 'natural'" (Van Maanen & Schein, 1979, p. 210), "normal" (Jablin, 2001, p. 756), and "proper" (Van Maanen & Barley, 1984, p. 238) for that "social context" (Leonardi, Jackson, & Diwan, 2009). Small talk, as much as formal lectures, helps to develop a sensibility for knowing how to act like a professional.

For engineers, the commonly circulating norms and practices in engineering culture include an essential commitment to solving problems by mobilizing the ostensibly objective and value neutral laws of science and techniques of quantitative measurement. Engineering knowledge is valued for its purported objectivity. Membership in the community of engineers is also understood to be achieved through objective criteria—a meritocratic selection of those who can do engineering, talent that is believed to be unevenly distributed but which the

profession expertly selects and trains using carefully crafted and tested standardized metrics (also see Fisher, 2012 for similar logics in Wall Street professions). As a consequence, young engineers have been observed to purposely exclude from their workgroups those they believe do not have equally high technical skills, paradoxically undermining the apprenticeship model the profession advocates (Dryburgh, 1999) and the collaborative work teams that employing firms expect (Leonardi et al., 2009, p. 401).

Despite the coercive power of professional socialization, each person brings his or her own biography to the experience where, indeed, students "try on possible selves" (Ibarra, 1999), interpreting the profession's values and practices and imagining themselves as professionals with the requisite confidence in their expert knowledge and career prospects (Cech, 2015). Would-be professionals experience this normative trajectory in varied, sometimes unanticipated ways, disrupting the powerful pull of the professional socialization narrative. If those disruptions are patterned for members of particular groups, such as women, they may lead to alternate and unintended consequences for intentions to remain in the profession.

Prior research suggests that the unexplained exit rates from STEM fields "is at least partially a result of the quality of match between the individual's interest and the requirements of the occupations" (National Science Board, 2012; Preston, 1994, p. 1459; Xie & Shauman, 2003) where the nub of the mismatch is embedded in subtle and tacit cultural signs and practices and speaks to the role of professional socialization in reproducing existing patterns of gender imbalance within male-dominated fields. If men and women perceive or experience a mismatch between the profession's culture and their own personal values, beliefs, and identities, they are likely to seek out other career paths more consonant with their personal values and ambitions. To the extent that professional cultures within male-dominated fields emphasize a homosocial, hegemonically masculine culture, we would expect that this socialization process may reproduce—or even exaggerate—the underrepresentation of women.

To explore the possible gendered processes of professional socialization, we conducted a longitudinal study of engineering students moving along a trajectory of professional socialization from (a) college entry to (b) initiation rituals in classwork and team projects to (c) anticipatory socialization such as summer jobs and internships. We examine men's and women's experiences and interpretations of those experiences as they reported them during their college years.

Method and Data

We followed cohorts of students at four schools who entered college intending to be engineering majors: Massachusetts Institute of Technology, Franklin W. Olin College of Engineering (Olin), Picker Engineering Program at Smith College (Smith), and the University of Massachusetts Amherst. Although our sample is not representative of all engineering students in the United States, the variety in type of institutions in our study (elite private college; large, public land-grant institution; engineering-only college; and single-sex college) allows for an examination of professional socialization processes across a broad spectrum of approaches to engineering education.

Diaries and Interviews

We tracked students from their freshman orientation through the end of their fourth year, when most of them have graduated from college. Rather than asking them to describe retrospectively their experiences at the end of the process, we asked a subset of students to tell us about their experiences in their own words through twice-monthly diary entries. With these data, we were in a position to consider the developmental process of becoming an engineer in situ, that is, as the experience unfolded. Students' diary entries were informative in three respects. First, they provided evidence of their interpretations of events and relationships that constitute their education over the 4 years and described the educational and career decisions they make as they are taking place. Second, the twice-monthly diaries provided insight into the culture and social organization of the field of engineering itself as enacted through engineering education. Third, by asking students to write to us about anything of interest happening in their lives at the time, we avoided priming informants through questions, even if subtle, about what may, or may not, be key to their lived experience. In three instances over the 4 years (3 out of 96 submissions), however, we did ask these diary writers to comment on specific topics: the 2008 presidential election, the World Series between the Yankees and the Red Sox (2004), and Larry Summers' comments on women scientists (2005). In all other times, we were as nondirective as possible.

We composed the sample of diary writers by random selection of students at each site. As appropriate, we oversampled women and racial or ethnic minorities. Because the proportion of racial or ethnic minority students is very small, in this article, we focus only on gender differences. As Sampson and Laub (1993) note, collecting prospective,

longitudinal data is "maddeningly difficult" (p. 276) to do, but as they also note, it is the only way to begin to understand sequencing. We offered each student $100 per month to participate in the diary writing over the course of the 4 years. Budget constraints limited the sample to 40 students across the four schools. See Table 1 for sample (see Tables 1 and 2).[1]

In addition to the diary data, we also conducted face-to-face interviews with 100 students (25 at each school) during their college years one and four. For this article, we reviewed students' interviews to identify the ways in which they articulated expectations concerning their career as an engineer, their confidence in the role of engineer, and their prospects in the labor market on the brink of graduation. The interview data in combination with diaries provide rich accounts of the educational experiences of these would-be engineers.

Data Analysis

All diary entries and interviews were coded using *Atlas.ti*. After the first semester of diary submissions and first set of interviews, Seron and Silbey independently read each diary entry and inductively developed codes to capture the range of topics discussed by students. Our analysis of the textual data developed from general understanding of the literatures on engineering, higher education, professional socialization, and gender, with an openness to the need to reformulate questions and developed additional categories as new themes emerged from the student diaries and interviews. Table 3 shows the codes and definitions used in this article.

Intercoder Reliability

As Table 2 reveals, we were dealing with an enormous sample of diary submissions; resources did not permit us to have each entry coded by two individuals for purposes of intercoder reliability. Yet, we were concerned about the consistency of coding across coders. To address concerns about intercoder reliability, we developed a process that combines independent coding with collaborative evaluation and recoding. Teams of three to four undergraduate students, under the supervision of Seron and a graduate student, coded diary entries by semester. In addition, each member of the team coded one common diary entry. At weekly team meetings, each assistant reported his or her codes for the commonly coded diary. On average, we achieve about 75% to 80%

Table 1. Number of Diary Writers by School.

School	Number of diary writers
Olin	9
MIT	8
Smith	12
UMass	12
Total	41

Note. MIT = Massachusetts Institute of Technology; UMass = University of Massachusetts Amherst.

Table 2. Diary Submissions by Year of Study.

Year of study	Total number of submissions
Year 1	615
Year 2	941
Year 3	1,167
Year 4	476
Total	3,383

agreement across coders. While this score is not as high as one would like for conversion to quantitative data (Nachmias & Nachmias, 1987), the goal here is quite different. Interpretation is a fundamental and inevitable aspect of analyzing qualitative data (Emerson, Fretz, & Shaw, 1995).

Becoming an Engineer: Entry, Initiation Rituals, and Anticipatory Socialization

Are professional socialization processes, events, and rituals differentially experienced and interpreted by men and women engineering students? To answer this question, we organized the coded data by the particular events being discussed. Professional socialization into engineering can be described by three kinds of experiences: (a) *entry and orientation* into a program of study with an unusually heavy dose of course requirements relative to other students' programs and majors, (b) *initiation rituals* such as collaborative team projects that familiarize students with the ways in which engineers work, and (c) *anticipatory socialization* through internships and summer jobs where students practice being a

Table 3. Codes and Definitions.

Code	Definition
Confidence	Self-confidence about school, able to do work, or not able to do work; assessing one's performance; competence to handle work; losing confidence in oneself
Engineer	(a) Any explicit discussion of engineering per se, (b) definition of, (c) profession of, (d) why engineering and me, (e) doubts about, and (f) social responsibility
Future	(a) jobs, (b) graduate school, (c) children, (d) marriage, (e) looking ahead, (f) making money
Gender	Any mention of gender with respect to self/other, composition of classes, and so forth
Identity	(a) Explicit discussion of discovery of social identity, (b) crises of identity (can be related to race, class, gender, etc.)
Jobs	(a) References to employment now or in the future, (b) concerns about, (c) getting a job for the summer, (d) internships, (e) resume, (f) making money, (g) careers
Professionalism	Habits of work, self-presentation; reliability, clean, tidy presentations; learning to "think like" an engineer; appreciating role of "clients"; joining professional associations; integrity; presentation of self as professional; going to other schools to meet with
Teams	And sports, class projects, informal study groups, free riders, left out/left behind, making a new group
Feedback	From teachers, grades, and so forth (no data for women on code)
Acceptance of oneself	Range of reflection on myself; coming to terms with self; reassessing self with this new experience; working harder, not doing as well; learning about oneself; not accepting self as is; how I am doing and want to do; how I am going to change (no data for men on code)

professional engineer. Table 4 presents an overall roadmap of our findings; we discuss our findings by way of these experiences—entry, initiation rituals, and anticipatory socialization—focusing on the (a) experience and (b) interpretation of that experience by men and women.

Our previous analysis of the longitudinal data from the surveys we administered each year to a panel of 700 students across the four schools found that school was not a significant factor in an explanation of

Table 4. Rituals of Professional Socialization.

	Events	Women's experiences	Women's interpretations	Men's experiences	Men's interpretations
Entry	College major in engineering	High achievement in math and science in elementary and high school	Confidence in math and science skills, looking for secure career with advancement and opportunities to help people	High achievement in math and science in elementary and high school	Confidence in math and science skills, looking for secure career with advancement and opportunities to solve problems
Initiation rituals	Membership in a cohort	Discovering a pecking order among initiates, no longer top of the class, uncertainty	Coping with pecking order. Seek validation from teachers and grades but don't question the circumstances	Discovering a pecking order among initiates, no longer top of the class, uncertainty	Coping with pecking order. Explain position by pointing to external factors
	Collaboration in engineering teams	Experiencing exclusion, relegated to helping role in design teams, can be managerial/leaders	Begin to question expertise, question whether engineering is meritocratic, some gender segregation	Applying math and science expertise to real-world problem, feed off group interactions and "show their stuff"	Begin to envision self as engineer

(continued)

Table 4. (continued)

	Events	Women's experiences	Women's interpretations	Men's experiences	Men's interpretations
Anticipatory socialization	Internships	Fewer opportunities to practice, assigned supporting roles, coworkers assume lack of expertise, also experience some confirmation of expertise	Begin to question the attraction of the job, and culture of engineering; the awkwardness of engineers. See work as mundane; lacking meaning; Problem solving for own sake consequences. Being a cog in a wheel. Some experience synergy/expertise and future work as engineer	Continuation of collaborative experience, confidence from previous experience that they bring, not alien but familiar	Confirmation of achieved skills, anticipation of career as an engineer. Experienced as supportive turning point

persistence (Cech et al., 2011). Hence, we examine students' diaries as a window into engineering culture at the stage of professional socialization as a group, rather than parsing out experiences by specific institution.

Entry Into Engineering Culture

To set the stage and discover students' experiences in their own words, we begin by briefly describing students' decisions to major in engineering.

Experience of entry. As Table 4 shows, men and women express similar reasons for entering an engineering major; both men and women describe being good at math and science in high school and are often rewarded for their strong performance (also see Correll, 2001; McIlwee & Robinson, 1992; Seymour & Hewitt, 1997). In addition, many think about college through a careerist or practical lens. They opt for engineering, often contrasting the choice to basic science because of an articulated concern about securing professional opportunities in the future.

In many respects, the students' descriptions of their decision to opt for engineering suggest a simple equation: Being skilled at math and science plus curiosity about how things work and logical thinking add up to the choice of an engineering major. Cecilia notes,

> I decided to pursue engineering simply because it sounded like the type of work I would enjoy and be successful at. I have always liked math and science, especially chemistry. I tend to think logically and rely on analysis over emotions.

In the privacy of a diary entry, Jennifer, echoing many of her peers, prizes being "good" at math and science and enjoys a certain added confidence and superiority (or perhaps "arrogance" she notes) compared with those who are outside this elite "bubble."

Women's interpretation of entry. In addition to the confidence that comes with talent in math and science, women (and men as we shall see) tend to enter college with a strong careerist orientation. It is not unusual for a first-year student to be thinking about courses in preparation for a job: Megan captures this sentiment and speaks for her peers, when she writes, "my goal for college basically is to graduate in four years [and] gain experience so that I'll be competitive in the job market."

Interestingly, women's interpretation of their entry into the profession is often coupled with a commitment to directing their career in socially responsible ways, or to use engineering as a career path to make a difference in people's lives. This theme is corroborated by research showing that women are significantly more likely than their male counterparts to be interested in engineering work that is "socially conscious" (i.e., specializations such as environmental vs. electrical engineering; Cech, 2014). For example, Juliette and Graciela express a desire to use their engineering skills to improve the situations of their countries of origin in Africa and Latin America. Megan, corroborating the hopes of a number of others, would like to use her engineering skill in "some type of humanitarian work"; she goes on to observe that, for the most part, men's priority revolves more around the "competitive" edge of engineering. This is not to suggest that women do not see themselves as "competitive" but rather that for many they express a more robust range of identities in pursuit of an engineering career (Cech, 2015).

Jennifer expresses a careerist narrative when she states that "this is the most convenient career," but she is also concerned about whether her image of engineering as "innovative" and "creative" is consistent with "real-world" practices: Does engineering really prepare one to only work on a small part of a larger project in relative isolation with little question about its contribution to society, or can one really "do something and call it my own" that, she seems to imply, embraces "community work?"

Men's interpretation of entry. Men also emphasize the importance of majors that will fulfill their long-term career goals in their decision to pursue engineering. With some delight, Brian, echoing many of his peers, writes,

> Last night while writing up my [engineering course] assignment, I all of a sudden realized that I loved chemical engineering. It was like an epiphany! Before, I had the attitude of "well, I like chemistry, and engineering seems neat, so I'll do chemical engineering. And besides, I don't know what else I would do." Now, my attitude has changed . . . to one of "I wouldn't want to do anything else(!)" It was amazing; I was just writing along, minding my own business and it hit me like a sack of flour. It made me feel very good about chemical engineering, and it made me more confident in my decision to pursue a degree in chemical engineering here . . .. A moment of self-confirmation, if you will. Beautiful, absolutely beautiful.

In contrast to their female counterparts, however, men do not express concern about leveraging engineering expertise to improve society. Also, social consciousness or social responsibility is not a significant predictor of men's choice of engineering specialization (Cech, 2014). In our analysis of both interviews and diaries, the absence of such concerns is systematic and underscores the ways in which men and women articulate their initial decision to pursue engineering somewhat differently.

Initiation Rituals

To understand the role of initiation rituals, we first examine how students cope with the discovery of their membership in a cohort, or the inevitable pecking order of talent, an initiation that is typical of socialization across the professions (Becker et al., 1961). Second, we turn to the initiation ritual of collaborating in engineering teams, the core of modern engineering culture (Tonso, 2007). In preparation for the real world of work in engineering, students are required to work on team-based projects, often beginning in their first year (Seron & Silbey, 2009).

Experience of membership in a cohort. Echoing findings from a vast body of research on professional socialization (see e.g., Becker et al., 1961; Granfield, 1992; Stover, 1989), engineering students compare themselves with members of their cohort almost immediately. As Table 4 suggests, students discover what they suspected: Even in these elite bubbles, there is a pecking order. Here too we find that while both men and women discover the pecking order, their interpretations of that discovery diverge.

Laced through students' discussions about why they decided to enter engineering, including the confidence that comes with recognizing that one is gifted in math and science, some students nonetheless express a lingering doubt about how they will fare in these competitive bubbles. These young men and women were at the top of their high school classes, took Advanced Placement courses and did well, earned SAT scores that put them among the top students in the country, and found time to excel at many extracurricular activities. Yet, our diarists write at length about their first exams, expressing general anxiety and concerns about time pressures. For example, Sam, expecting that he had failed a test, describes how he was "extremely happy" when he got the test back and learned that he had done very well—a 94%. Not surprisingly, the experience left him feeling "confident" that he would do well.

Now with this first sorting exercise successfully behind him, college did not seem "as scary as many people have always told me."

A ritual of the first year is a shared concern that one may no longer be at the top of the class and then assessing where one fits into the pecking order among these high achieving peers. As Caroline writes,

> You have the geniuses that are really smart without even trying, those who are pretty smart and work hard, and those who really just have to work extremely hard to get the grades they want . . .. I'm not exactly sure where I fit in but I think somewhere between the second and third group.

As a general pattern, these students' expectations are confirmed: There are many peers whom they perceive to be smarter. After scoping out where one fits, the next step is to figure out how to come to grips with the realization of the stratifying categories and one's place in them.

Women's interpretation of membership in a cohort. On balance, many of the women (and men, as we show later) bounce back and move along to the next step in the credentialing process. Illustrating this, Rachel writes,

> The fact I came out with all A/B's was of course just icing on the cake of being done with my first ever college exams! I know they only get harder from here on out, but this is me we are talking about, I'm not worried, I'm not stressed, I simply can't wait, bring on a challenge!! I mean a challenge to learn is why I am here, right?

But, recovery from initiation rituals for women also reveals an interpretation of this experience that is not broadly shared by their male counterparts. For some women, the experience triggers a more fundamental doubt about their abilities to master the technical constructs of engineering expertise. Ashley describes her experience this way:

> The biggest problem I seem to be having [is] self-doubt. I would look at a problem, and think of a way to solve it, but then I would second guess myself, and convince myself that my way of answering the question must be wrong, but then, it would turn out that I was correct the whole time. I don't understand why I keep doubting myself so much . . .. Lack of confidence has never ever been a problem for me, even when I was a little girl . . . . . Hopefully, this talk with my physics professor today helped.

In addition to coping with the new experience of questioning her confidence, Ashley's last point here—"hopefully, this talk with my physics professor today helped"—captures a theme that distinguishes the experiences of many women. That is, women are much more likely to write about looking to others for positive cues and sources of approval, including teaching assistants, professors, and advisors. Men do talk about this, but, as we show later, they do not necessarily externalize the searching process by explicitly looking for confirmation (see also Valian, 1999). As we show in findings regarding anticipatory socialization, this search for positive cues carries over into expectations for feedback from supervisors at jobs and internships.

Against the backdrop of a "master narrative" of a lock step, time-intensive professional socialization, many women carve out a strategy to cope with these rituals by turning to peers and teachers to affirm, and reaffirm, their confidence. For example, Taylor reflects on an encounter with a teacher following a class quiz:

> When I went up there [to his office], he asked me if I had gotten my last quiz back . . .. I said no and he then proceeded to tell me that I had done well and that I was improving . . .. [H]aving a professor take the initiative and recognize me was really encouraging. It boosted my confidence and helped me to stay focused on my next quiz. I think it is really incredible how much recognition and positive support from a teacher can motivate a student . . .. But one negative comment or one action that makes them feel stupid and not worth a professor's time can drop a student's self-confidence. It makes them second-guess themselves and think badly of themselves.

Men's interpretation of membership in a cohort. As other research has shown (Dryburgh, 1999), it is typical of men in engineering to interpret the discovery of the pecking order in a positive way, bouncing back with confidence and ready to move on. As this quotation illustrates, Brian is still fairly confident and what he thought might be hard to take has turned out to be exciting.

> It's really weird coming from high school, where you can understand things faster than most people, to a place where everyone is at your level. After I was accepted, I was a little intimidated about the idea of not being as smart as everyone around me. However, once I got here, I found it more exciting than disappointing. While it was humbling to see

> that everyone here had more talent or "brains" than me in one area or another, I found it to really be amazing that people were so cooperative, and willing to all contribute their individual strengths to make a group work—it really makes for some great potential to do things.

Some of Brian's male counterparts have the new experience he did not have, of earning a poor grade on a first exam. Typical of what many others have found, the men tend to chalk it up to not studying as hard as was required, spending time on other things, not managing time, or blaming some other external set of pressures (Valian, 1999). The poor grade does not become a source of expressed uncertainty about ability to do the work. Most men come out of the sorting process finding that, as Aaron puts it, his "self-esteem has risen back to a pretty normal level." These men cope with this initiation ritual by tending to take their competencies for granted; they did not articulate the moments or experiences of self-doubt. Many will describe instances where they receive a complement, or positive feedback, but it is not interpreted as an indication of whether engineering is right for them. Or, as Dylan notes, he's not all that worried about his grades and accepts the fact that he may not get straight A's his experience in high school. Rarely, if ever, do men mention the effects of a professor's comment on their self-confidence, positive or negative. Even in the privacy of their diaries, many of the men exhibit the "macho" culture of engineering that no doubt contributes to the "chilly climate" experienced by women (Dryburgh, 1999; Sandler, Resnick, Silverberg, & Hall, 1996).

Collaboration in Engineering Teams

The initiation rite of scoping out where one stands in this new, somewhat more rarefied pecking order is typical of all professional socialization processes, whether in law, medicine, or engineering. Each profession, however, also introduces students to its distinct culture, its distinct skills, language, practices, and values. For example, in her study of law students across multiple schools, Mertz finds what she describes as a "metapragmatic structure" of learning legal language to "think like a lawyer" (2007, p. 130). In engineering, one finds a similar "metapragmatic structure" in preparation for the organization of engineering work itself, work that is structured through collaboration on team-based projects (also see Seron & Silbey, 2009). Engineering students quickly discover that mastery of collaboration and teamwork

constitute a core component of *being* an engineer and they set out to "try it on" (Ibarra, 1999).

Women's experience of collaboration in engineering teams. Rachel discovers the advantages of teamwork and writes in her diary:

> Its also really nice when its Tuesday night and you are trying to defeat your Physics homework and there are fifteen other people trying to defeat it too. Say I struggle and I get number ten, but I struggle and I can't get number thirteen. I walk down to [Jay's] room to find that he got number thirteen but he spent the last twenty minutes not being about to get number ten. I explain ten, and then he'll explain number thirteen . . .

Kelsey writes of her preference to work alone, "believing it was quicker and more efficient." But her experiences of team projects corroborate what her father (a software engineer) has told her, "cooperation I can see, is instrumental in engineering."

But, women diarists and interviewees also report that initiation into collaborative engineering teams can include some fairly negative moments (cf. Koput & Gutek, 2010, p. 97). Typical of others, Kimberly describes how these negative aspects of collaboration unfold:

> There was this one case where, in our design class, two girls in a group had been working on the robot we were building in that class for hours, and the guys in their group came in and within minutes had sentenced them to doing menial tasks while the guys went and had all the fun in the machine shop. We heard the girls complaining about it—in fact, one of them ended up on the group who was doing the project with me, which was cool. Hmmm maybe we were a little biased, but I'd rather be biased as a woman than biased as a man; men are way too biased anyway.

Sara describes how she found the men on her team projects to be "nerdy" and arrogant; she asks herself "is this really the kind of people I want to work with?" This exclusion is often based on implicitly held (and sometimes explicitly expressed) gender biases about the "natural" talents of men and women.

In our interview with Ramah, a student who believes that what she has learned in her engineering classes will help her to solve some of the development problems in her home nation, told us that in her experience women students are not marginalized. "Didn't you see," she said during our interview "that women students were in charge of four out of five of

the final teams in the project competitions this semester?" Ramah recognized that women were managing the projects rather than actually building the design. Like the Australian women engineers studied by Avre, Mills, and Gill (2013) who redefined the work of engineering to be about management, communication, and leadership (also see Fisher, 2012), Ramah did not think this a subordinate or outsider position as did other women students. Ramah interprets this as an agentic position within the teams and feels empowered in the managerial roles.

Rachel describes her experience with a design competition where her "girl group" developed a system to "make it easier to get a full trash bag out of a trash can." She goes on to note that "we were the only girl team and we got in second place! There were a total of 15 teams and we rocked it out." After being judged by professors, teaching assistants, businessmen, and other students,

> our professor wanted to get a picture of our prototype and us. We picked up our prototype and were all smiling and looking all professional; then he said: "You guys look like professional catalog models; this picture could go in a catalog and you could sell big time." It was kind of out of the blue, but at least it was meant to be a compliment . . . at least that is what I would like to think.

When these negative experiences unfold through team-based projects at school, women often describe the importance of debriefing with friends to vent their anger and move on. Reflecting on her education, Natalie describes this process:

> I think . . . women in—as engineers—we need [support] because I think our learning style is a little different at times, and communications styles. And, so when there's a lot of, you know, typically outspoken guys in class, then you end up feeling like you don't know anything because they are talking a lot, and answering the questions. So, it's good to talk to other people who have similar experiences.

Interestingly, and importantly, this student goes on to describe a team she is working on "with a couple of guys" to "design a car, fundraise, and build it"; for her the venting works and she moves on.

Women's interpretation of collaboration in engineering teams. In their diaries, many women describe the support that they receive from the Society of Women Engineers (SWE). Founded in 1950 by pioneering women in

engineering, its mission is captured in the motto, "Aspire, Advance, Achieve." SWE seeks to encourage women to find agency and power in their pursuit of engineering and, in doing so, to stay in the profession. Inviting public speakers and organizing networking events as well as conferences, SWE plays an active and well-institutionalized role in women's professional development as engineers. Most of the women at the four sites describe interactions with SWE, attending campus meetings and seminars, national conferences or becoming officers of their chapter. As many women reveal through their diaries and interviews, SWE is integral to their socialization into the culture of engineering. They describe SWE as a site where they begin to discuss *and* interpret their negative encounters with their male peers in collaborative projects. An oft-repeated phrase, "Fake it 'til you make it," comes up in the context of discussions about SWE where it apparently circulates. Our respondents describe how participation in SWE activities teaches them how to "try on" engineering (and professional) personas and develop professional networking and negotiating skills. After attending a seminar on the "Cost of Not Negotiating," a seminar organized around a strong motif of feminism with a different voice (Gilligan), Taylor notes,

> It was talking about what you need to do when you are going for a job. Both with money and with job benefits and opportunities. It was interesting to learn how women negotiate differently than men and sometimes do not ask for what they deserve. We play a game [at the SWE workshop] where we had to negotiate splitting $10 between two people, but you could not split it in half. It was a weird position to be in because you are negotiating with your friends, but it was a good experience to be willing to put yourself out there.

For many women, their first encounter with collaboration is to be treated in gender stereotypical ways. As they debrief with peers, and in some instances female professors, they interpret such encounters through a lens of individual responsibility to develop the strategies that seem to them to come naturally to their male counterparts. They recognize that they need to develop to be taken seriously as professionals with expertise and authority, while they fail to notice that they develop these skills in collaboration with other women rather than individually by themselves. Their descriptions suggest that they do not question the individualist and meritocratic ethos of engineering culture; rather, they vent their anger and then brainstorm with female peers or professors to navigate the experiences, avoiding consideration of the

structural or collective aspects of their experiences. SWE celebrates an individualistic and meritocratic ethos "while also advocating for specific tenets of liberal and cultural feminism, such as gender equality and the celebration of gender differences" (Fisher, 2012, p. 8). In many respects, the role of SWE in the culture of engineering mimics what they may likely encounter on their future jobs as corporations set up affinity groups where women and other minority groups may find a comfort zone to air their concerns around their "marginalized status"—and, to then move on with the work at hand (Williams, Kilanski, & Muller, 2014, p. 468; also see Dobbin & Sutton, 1998).

Men's experience of collaboration in engineering teams. Dylan observes the teamwork of his professors and begins to extrapolate "lessons" for himself:

> The professors [in my team taught course] are very cool, although very different. One is very laid back, while the other is much more professional. The laid back one is much more willing to explain things, but the professional one is much more helpful in the long run. Explaining something to me will help me now, but I will just have similar questions in the future. The professional teacher helps me in much less specific ways. For example, he will tell me that my presentation took the wrong approach in presenting my data to the audience, or he will question me in such a way as to show me the weakest part of my presentation. I end up learning things about how to act in the professional world, which I think will be much more helpful in the long run.

This diary entry from Dylan suggests that he is thinking broadly about the skills he needs to develop if he is to advance from initiate to professional. He uses a classroom experience to model what he believes will be required in, as he puts it, the "professional world." Dylan is acquiring a robust sense of his professional role confidence, one that moves comfortably between his emerging expertise and his confidence in his comfort with engineering, his career-fit. His experience is by no means unique, however. Brandon reports that he is working on a research project for a professor, describing the ease with which he is able to correct his professor and the pleasure he took in contributing to the group's work:

> I made a pretty big stroke of progress last week, where I ended up proving the professor wrong on something she had done last year, which actually helped us find better results (well, also more correct results) . . .. [I]t's really

> a blast working on something like that—kind of my "stress relief" for the week.

In guiding the professor's lab team through this correction, Brandon displays both the specific expertise and more general habits of mind required to fit and succeed in his chosen field.

Men's interpretation of collaboration in engineering teams. The men in our sample describe overwhelmingly positive collaborative experiences, even when they might have expected otherwise. These moments provide an opportunity to test and to gain confidence in their increasing expertise and, even at this early stage, to try out being an engineer. Typically, the men interpret their collaborative, team-based projects in great and often technical detail. While perhaps more detailed than many, Eric's description of a design project echoes that of many of his male peers:

> We set about coupling our 7.2 volt cordless drill motor to the dynamometer to determine its no-load speed, stall torque, and its current draw at different torques. From this data we were able to create a rough torque-speed curve and determine what size sprockets we would need to build for our chain-and-sprocket transmission . . .. We obtained precision-ground rods for our axles, more acrylic, and ball bearings (which we eventually did not use). We actually did use the large machine shops once on Friday to have them fabricate acrylic wheels for us on the laser cutter, and this was a wise move, for the wheels were of impeccable quality. Over the weekend, after I took my math test on Saturday, the home stretch of car building lasted through 2 a.m. in the mini shop on Sunday, at which time I had visualized, sketched, and built an adjustable angle solar canopy structure within just a few hours. The chassis, bearings, and axles were complete, and I attached my canopy before catching four hours of sleep.

Eric speaks with confidence about the nuances of this hands-on design activity. His comfort with the tasks and language involved in this design project suggests his emerging professional confidence. Also corroborating the description of many of his male peers, they focus on the technical aspects of a project.

Anticipatory Socialization

Team-based projects in classes serve as a prelude to students' internships and summer jobs where work is inevitably organized into teams.

Students often look forward to internships and summer jobs with great anticipation, providing an opportunity to practice being an engineer with real clients and in the kinds of workspaces and groups they will enter after graduation. However, the masculinist culture of engineering extends to engineering workplaces (McIlwee & Robinson, 1992). Even in engineering subfields where women are more represented or are otherwise seen as more "woman-friendly" (e.g., industrial engineering), women are more often assigned to more "social" work activities like communication with customers, while men are assigned to more "technical" work activities like design (Cech, 2013b).

As Table 4 suggests, women's experiences in internships or summer jobs are, in many respects, a continuation of the gender stereotyping they experienced with peers through school projects. This second round of gender stereotyping in the workplace, coupled with the somewhat greater isolation from supportive peers, faculty, and SWE, lays the foundation for a revised interpretation and questioning of whether engineering is really what these women want to do. In contrast, the experiences of men in internships continue to be synergistic, providing multiple opportunities to experience the link between theory and practice and to begin to envision themselves as engineering professionals. Almost without exception, we find that the men interpret the experience of internships and summer jobs as a positive experience, indeed often as a highlight of their education. Women's reports are not as uniformly positive.

Women's experience of internships and summer jobs. Among the women, internships often come with some unintended effects. It is important to note at the outset however, that many of these women have experienced internships and summer jobs as opportunities to undertake empowering professional tasks and experience positive feedback. Speaking for others, Kimberly and Rachel describe internships or jobs at large corporations in positive terms. For example, after a slow start and many questions, Kimberly is "firmly entrenched in her new job," that the place is "intense! I like it . . . [and] now I am . . . a little assistant and we're working with nanopowders and making samples. [It] has turned out to be so much fun." Rachel describes a "successful month" where she has "made about 6 different drawings and a whole model/assembly . . .. I can actually tell other people, with confidence, around there that they are wrong and that things should be done a different way." She goes on to note that she has been "stealing the show, at least in my mind . . .. Oh c'mon I'm just trying to make myself feel as important as possible!"

Besides positive experiences with the actual engineering activities in the internships, several women encountered stereotypes, sexism, and marginalization in their internships, as Rachel elaborates:

> But, one thing that really bugs me about being an intern and a young girl is that the people whom I work with don't take me seriously. Not everyone does this, but a fair amount of the older men in my working environment do this. They'll treat me like I know nothing, and I am only working at [a large defense contractor] because my dad works there. What they don't know is that I have a 3.7 GPA and am practically acing all of my grades . . .. Anyways, I just can't stand it when men look at me as being a dumb blond; I mean they end up treating me with no respect. They never give me the time of day and just ignore what I have to say, especially since I am a young woman. But, don't get me wrong, there are absolutely amazing people working at [the company]. The majority of people do give me respect . . .. There are just some people who you can't avoid; they are everywhere and always look down on woman. I never used to really care, but now when it interferes with my profession it just irritates me.

This experience is by no means idiosyncratic. Aurora describes her current internship in positive terms but makes clear that this is in distinct contrast, she notes, to an earlier experience:

> So I'm two weeks into my research position and for the first time in my "working career" I'm really enjoying what I'm doing. The last two summers I've been working in an engineering internship position at X, the military defense government contractor . . .. The environment was creepy, with older weirdo man engineers hitting on me all the time and a sexist infrastructure was in place that kept female interns shuffling papers while their oftentimes less experienced male counterparts had legitimate "engineering" assignments.

Invited to visit a building site during an internship, Jennifer describes how she was "seriously offended" when a supervisor spoke to her about appropriate dress for the occasion and reminded her "No tank tops, now. We wouldn't want to distract the guys." As she goes on to reflect on this inappropriate comment, she notes, "That's all that he thinks that I'm good for—a piece of meat." While she felt like taking him on, she realized that because he is a "supervisor and all that," it was best to not say anything. After the incident, she learns that "he does this a lot so

either he is really inconsiderate or he doesn't know that he is an unpleasant person that makes inappropriate comments. I will try my very best to be pleasant towards him tomorrow."

Haley reflects on her confidence in engineer's fit with her aspirations, focusing on whether the career path is too "boring" and "unfulfilling:"

> The problem is that now I'm not sure if I can see myself being happy with an engineering job…. And there are so many other things that I find interesting as well…. I'm worried about getting stuck for too long.

Brooke ruminates on the "socially awkward" stereotype of engineers and questions whether she wants to be part of this professional community. She realizes that her studies in pursuit of an engineering degree have narrowed her horizons and she feels less educated that her classmates who are not engineers. She feels the engineering world is limited.

> [I]t's not just the extreme workload that sucks; I have recently noticed that I cannot keep up or contribute anything of value to conversations about politics and current events. I simply have no idea or understanding about what is going on in the world right now. All through high school I loved having political debates with people, but I haven't been able to take a single class in public policy, government, or social science in college, which are the subjects that Smith is known for…. No wonder engineers are stereotyped as being socially awkward. The typical first meeting question of "what are you majoring in" never really leads to interesting conversation. In fact, I got so many awkward silences from telling people my real major that I started telling people that I was majoring in architecture. Trust me, architecture majors have much more interesting conversations than engineering majors.

Women's interpretation of internships and summer jobs. Overall, we find that collaborative moments in internships and summer jobs carry mixed messages that compromise women's career-fit confidence. More isolated from their campuses, affinity groups, and their support networks, these experiences begin to raise questions, if not doubts, for women's assessments that an engineering career is where they will be able to find satisfying and rewarding work, be successful, and fit with their interests and values. Reflecting on her summer job at a computer company outside of Boston, Megan captures the turning point as a "quarter life crisis," a label that many of her female peers would recognize from

their own accounts. The details of the crisis play out differently among these women, but the effect is to raise questions about whether engineering is the right career path.

Graciela has a summer internship in England and describes an incident where she did not complete an assignment in the timeframe required. Her boss, probably appropriately, made clear that she had cost the company a significant sum of money. However, the reprimand shakes her confidence, leaving her asking, "Am I ready for the corporate world?" Taylor and Heather describe their jobs as "boring," in part because they are not given assignments that are sufficiently meaty or they spend long stretches of time without anything to do. They begin to wonder, as Megan and Kimberly put it, if engineering is really what they want to do, whether as another student puts it, there is a certain "mundaneness" about working in industry as an engineer.

Another pattern emerges from these descriptions: Laced with the excitement of a synergistic moment when expertise and career-fit come together, these women are equally likely to encounter demeaning comments about women that suggest that it may all be a part of engineering culture. These students come to realize that sexism is not just an annoyance but may be part of her everyday workplace experiences after graduation (Faulkner, 2007, 2009). Some informants are able to find agency despite these disadvantages and uphold their confidence in spite of this sexism and, indeed, may stay the course in engineering. But other women's confidence might not be so resilient in the face of such direct challenges.

At the entry to college, these women took seriously the idea that engineering is a path that they would find enriching and fulfilling if leavened by careerism, but with increasing experience in actual engineering workplaces, they find the path uncertain if not actually taking them in the wrong direction. The accumulation of these micro encounters that begin with school projects and then continue through internships and jobs raise many women's concerns that engineering might not be the right fit for them. Interestingly, as they contemplate departure from engineering, many are well aware of the data on women's persistence in engineering and, indeed, wonder if, as Laura comments, "in abandoning" her trade, she will be "just another figure in a women in engineering survey that says X numbers drop out after their last year." Whether in encounters through work or contemplating research on career trajectories for women in engineering, the process of facing the reality of sexism and the routine work they see themselves doing plays a role in undermining their confidence that they fit within engineering.

Men's experience of internships and summer jobs. Typical of his peers, Brandon describes a summer job where he finally feels that he is learning what it is like to really "work," to please a boss, and to understand the social requirements or skills of a workplace. Travis notes that an internship at a large corporation demonstrated that the things he's learning in class are

> definitely good to know, [but that] it's not really important to memorize all the specifics of everything . . . because when you get a job, you know how to look it up . . .. I think having common sense and just a general idea of how things work is most important.

Adam ruminates about the importance of "putting yourself out there," making "mistakes," and having the confidence that "people are there to tell me if I mess things up." As he notes, "that is the exact point of getting an internship [because] you can't get these experiences by taking classes or doing campus research." Or, Dylan describes a presentation before faculty and representatives from the Air Force that was "an amazing experience of presenting to people who were older, more experienced and better educated than I am but nonetheless interested in what I am doing." For these young men, there is a synergy between expertise and career-fit confidence across the porous boundary of school and work that, together, lays the foundation for professional role confidence.

Men's interpretation of internships and summer jobs. Typical of many of his peers, Adam describes and reflects on how he's doing at landing a position after graduation:

> In one sense, I felt "like a pro" walking around the booths [at the job fair]. I still felt reservation in approaching companies. I thought twice about who I should talk to. To a certain extent, that is good, because time is limited and I need to filter out the companies that I truly am not interested in. But then on the other hand, extra experience never hurts and an interview with a company that I'm not 100% interested in could still help me in my interviewing skills. While I still don't have a strong sense of specifically what I want to do, I'm pretty acquainted with how the system works of approaching company representatives.

Not all men are as convinced as Adam that the engineering profession is the right fit. Some students reflect on how they enjoy problem solving

and think that engineering is the right path but are still drawn to other fields like mathematics or medical school. Nonetheless, the positive experiences from school to work tend, if with some setbacks for a few, to be confidence builders for these young men.

Overall, men's experiences of internships and summer jobs are of a piece with the confidences they gained through team-based projects at school. For the most part, these high-achieving men continue to enjoy robust confidence in their engineering expertise, and this translates into confidence in pursuing engineering employment or graduate school. As the quote from Adam reflects, men's questioning tends to focus more on practicalities of engineering work and less on ruminations about whether it will be the right career-fit for them. We do not read that the men are concerned that their jobs will be boring or lack meaning. The anticipated turning points in the "master narrative" of engineering professionalization works as expected for men, regardless of whether they translate that confidence into a job in engineering postgraduation or pursue a different path.

Discussion

How do engineers in-the-making experience and perceive engineering culture? Initiates' entry into the profession is one of immersion in a language (math and science); needed to think and speak like engineers, encouraging, if not channeling, aspiring engineers to appreciate the ways in which this technical expertise is essential to design practical solutions to real-world problems. Initiation rituals and anticipatory socialization combine to introduce initiates to modern engineering work through further, if sometimes reluctant, immersion in required team-based projects. Recent changes in work organizations—specifically the emphasis on project-focused work teams—have infiltrated the culture of engineering education (Gorman & Sandefur, 2011; also see Tonso, 2007). This "metapragmatic structure" (Mertz, 2007) of teamwork has become the lynchpin of engineering socialization and culture in higher education, from entry through anticipatory socialization.

Our findings show, however, that this modern master narrative of engineering and metapragmatic structure of socialization into the professional culture plays out differently for men and women students in subtle but powerful and cumulative ways and suggests how and where sex segregation begins. At entry, men and women share an interest in engineering for its practical, hands on, careerist orientation to solve "real-world" problems. But, men and women interpret the real world

differently: Whereas men do not specify what this term means to them or for their emerging identity as engineers, more or less taking it at face value, women often specify real world to mean a commitment to solving problems that will improve the quality of life or serve the public. As their diary entries and interviews reveal, these young women often elaborate on their attraction to engineering as a field that will allow them to make a difference through socially conscious engineering projects.

As students move through initiation rituals, discovering the inevitable pecking order in highly selective professions and being thrown into team-based projects, findings again reveal subtle differences in the interpretations and strategies among men and women. Typical of the coercive first year initiation rite of all professions, engineering students describe their anxieties and fears about whether they can make it through the program. Most men and women seek agency within this ritual in different and telling ways. Corroborating other research (e.g., Valian, 1999), our findings show that men tend to weather the process without it undermining their confidence. By contrast, many of the women seek affirmation of their abilities to continue, often turning to peers or professors for assurances that all is fine. Initiation into teamwork further highlights the ways in which men and women deploy different strategies to cope with the rituals of engineering culture. For most men, teamwork is the first of many synergistic moments where theory and practice come together. As they try on the role of being a member of an engineering team, men tend to describe an exciting, often exhilarating congruence between aspirations and accomplishment, giving them added confidence that this career path is the right track. For women, teamwork is often a rude awakening, their first exposure to not-so-benign gender stereotyping. They discover that their male counterparts assume that their role is to organize and manage the team while men do the real work in the shop, tinkering with toys or running models to forge an elegant design or efficient solution. Many women describe turning to SWE for tips on how to effectively navigate teamwork so as to better adapt to engineering's normative practices but generally do not question the underlying structure or culture of engineering.

Finally, anticipatory socialization underscores yet again the ways in which the experiences of men and women diverge. Men describe internships and summer jobs as moments when they become true professionals. They describe their growing competence in knowing how to ask questions, learning from mistakes, or enjoying their contribution to a project. On balance, our findings show that, whether they plan to stay the course in engineering or not, the master narrative of engineering has fulfilled its

promise. In their diaries and interviews, women's accounts of internships and summer jobs differ from that of men. They describe a culture that is isolating, that often assumes women are second-class experts, and where sexism is normative. But, for many women, the most chilling discovery is that engineering may not have room, or take seriously, a commitment to a socially conscious agenda that, as we noted earlier, was a key motivator for them in the first place.

As men and women move through the socialization processes for transforming novices into expert professional engineers, their experiences of these events differ and often lead to disparate interpretations of the events and the profession. None of these differences, however, suggest that engineering education has failed to inculcate the skills, norms, and values of the profession. In fact, the socialization rituals, including both the explicit expectations as well as tacit, metastructures successfully reproduce the master narrative of the profession. However, it is differentially embraced by men and women because the same stimuli, we might say, the same events, have differential effects on men and women. Women's socialization is often disrupted by encounters that, taken together, make it difficult to discover that all-important match between the self they recognize and the professional that would enable them to embrace, embody, and take for granted the culture of the engineering profession. At every point in professional socialization, these findings reveal why and how men enjoy the opportunity to cultivate increasing confidence that they belong in engineering whereas women confront obstacles and innuendos that leave them questioning whether engineering is the right field for them.

Conclusion

In concluding, we posit that the findings reported here have theoretical implications for understanding the persistence of sex segregation within professional occupations and consider the policy implications for the enormous challenge of changing engineering culture.

Beyond the lingering effects of discrimination and harassment (Acker, 2006), network effects or the challenges of work–family balance (Jacobs & Gerson, 2004) in gendered patterns of departure, our results suggest that day-to-day engagement with cultures of male-dominated professions during professional socialization is potentially an important factor in keeping men in and pushing women out.

The findings reported here suggest that subtle and cumulative encounters with the values and norms of professional culture

compromise women's affiliation with the profession and raise the prospect of departure. Immersion in the organization and culture of the profession encourages estrangement rather than attachment and the grounds are substantive and normative rather than instrumental. A broader factor in the reproduction of sex segregation, at least in professional occupations, is not only the gender biases and chilly climates often documented in male-dominated professions (e.g., Rosser, 2011; Valian, 1999), but the exclusionary practices and assumptions imbedded in professional cultures of these fields and enacted through the professional socialization process. An important finding from this study is that professional socialization itself mimics sex segregation that others have identified in the workplace.

This finding has important policy implications for engineering. For the better part of the 20th century, reform of engineering practice has been accompanied by school-based curriculum change (Seely, 1999, 2005; Seron & Silbey, 2009). Many engineering programs have introduced a greater emphasis on design and team-based learning in the classroom, in essence mimicking and modeling the worksite, not only because it is arguably more creative and effective work practice but also because it is assumed that this will complement women's social talents and enhance their opportunities for persistence in the field (National Academy of Engineering, 2004; Sullivan, Colby, Wegner, Bond, & Schulman, 2007). We find, however, that a gender differential in students' professional role attachment tends to be produced in exactly those collaborative encounters in team-based design projects and in the workforce through internships in organizations.

Reform of engineering education to encourage gender parity will, however, never succeed as long as the focus is exclusively on the curriculum at school because, as these findings make clear, it is often the experiences in work groups at worksites that compromise women's confidence and commitment to pursue a career in engineering. Thus, programs in engineering that are indeed committed to making a difference need to take steps to educate the leadership at worksites that recruit their students to expose and repair the role they play in discouraging the very incumbents they claim to want to hire (Koput & Gutek, 2010, p. 94). While this is no doubt a challenging undertaking precisely because the boundary of professional education is so porous, one may envision starting with a program's advisory board, or board of overseers who, after all, bring a commitment to the quality of engineering education at a particular institution. In bringing advisory boards into

the conversation, it is equally important to migrate away from psychological or individualistic explanations of women's confidence to analyses that situate that confidence in structural and cultural contexts (also see Williams et al., 2014). In the face of women's attrition from engineering, the tried-and-true response is to propose yet another curricular reform. Without taking account of what is learned indirectly through initiation rituals and anticipatory socialization and its attendant impact on women's professional role confidence is to miss yet one more opportunity to achieve parity in a profession that has demonstrated remarkable resilience in maintaining the status quo.

Note

1. Because there are a relatively small number of diary writers at the smaller sites (i.e., Smith and Olin) and a relatively small class of engineers at University of Massachusetts Amherst, to protect the confidentiality of the writers, we do not report the exact years of data collection. These data were, however, collected post-2000 and continued for 4 years.

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