Flexible lives on engineering's 'Bleeding edge': gender, migration and belonging in the semiconductor industry

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FLEXIBLE LIVES ON ENGINEERING’S ‘BLEEDING EDGE’:
GENDER, MIGRATION AND BELONGING IN THE SEMICONDUCTOR INDUSTRY

by

Sarah E. Appelhans

A Dissertation
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Doctor of Philosophy

College of Arts & Sciences
Department of Anthropology
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This dissertation explores gender, flexibilization, and belonging within professional high tech employment, particularly amongst women and migrant engineers. Prior studies of women in the “integrated circuit” focused on low-skilled factory labor (Nakamura 2014, Grossman 1980); however, women are increasingly choosing careers in the male-dominated engineering workforce, which designs and manufactures semiconductor technology. Fieldwork for this dissertation took place between May 2018 – Aug 2019 in the Northeastern US, a regional hub for semiconductor manufacturing companies. Thirty-eight life history interviews were conducted with participants from several companies in the area, along with frequent follow ups and participant observation with seventeen engineering families. This data was supplemented by close monitoring of local and national news related to immigration and high-skilled labor. This dissertation works at the nexus of anthropology and engineering studies, bringing together anthropological perspectives on gender, migration and transnational labor with studies of gender and ethnicity in engineering. To anthropology, I bring an analysis of how transnational capitalism produces flexible citizens, who perform complex negotiations of gender, race and ethnicity in a multicultural high-tech workplace. To engineering studies, I offer a perspective on gender and race in engineering that transcends national boundaries and shows how global political and labor structures shape the experiences of engineering workers. Building upon Gammeltoft’s conception of belonging as an essential human need, I demonstrate how neoliberal modes of workplace discipline erode women and migrants’ sense of community through cultivated logics of efficiency, flexibility, and individualism. Thus, in contrast to substantial literature on women in engineering professions that investigates identity and gender performance, this research demonstrates how neoliberal logics and market structures also
undermine women’s professional stature and their career prospects within the firm. I find that these engineering outsiders endure intense flexibilization and face gendered and racialized codes of conduct in this male-dominated career. Drawing upon feminist critiques of flexibility, I find that here at the “bleeding edge” of technological production, due in part to the engineering profession’s dependence upon management, women and migrant workers have few options beyond increasing feats of self-discipline. I theorize belonging as a holistic alternative to “inclusion”, arguing that the logics of efficiency and flexibility impede the essential care work needed to produce belonging on the frontiers of flexible labor.
ACKNOWLEDGMENTS

My unorthodox path from engineer to anthropologist has been both challenging and exhilarating. It was not easy to change directions in the middle of my career and there have been many false-starts and stumbles in the past eight years of study. However, I am tremendously grateful to the many people who have made this transition a fulfilling and enjoyable journey.

I would like to begin by thanking my research participants for trusting me with your stories and sharing your lives with me. One of my goals has been to tell your stories in all their complexity, staying true to your descriptions of your lives. I hope that I have represented you well and that you find my interpretations thought-provoking and illuminating.

This work has benefitted tremendously from the support of my advisor, Dr. Elise Andaya. Your careful attention and feedback throughout the past eight years has been invaluable. I have made the transition from engineer to anthropologist largely through following your example.

I would like to thank my doctoral committee, Dr. Atsushi Akera, Dr. Jennifer Burrell and Dr. James Collins, for your support through the ups and downs of fieldwork. There were moments when it nearly collapsed, and each of you has done your part to help shepherd this project to completion. I also thank you for your valuable feedback on this manuscript, which has helped me reflect more deeply on the precarity of the global engineering workforce.

None of this would have been possible without the support of my family. My partner, Tom Oldfather, has been a constant source of encouragement and confidence through all stages of research, teaching, fieldwork and writing. Thank you also to my parents, Victoria and Richard Appelhans, my parents-in-law, Michael and Kathleen Oldfather, and my sister, Rachel Appelhans. I’m sure I surprised you all by leaving a seemingly lucrative career in engineering, but you never wavered in your support and enthusiasm for my work in graduate school.

This work has been arduous, at once a labor of love and a calculated risk. It began as a quest to understand my own struggle in engineering and has resulted in finding belonging in a new profession. Thank you all for your support as I have brought these thoughts into the world.
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INTRODUCTION

Moments of crisis often reveal the fractures within social systems. Like flashes of lightning, momentarily illuminating the dark landscape, all of a sudden we see our obstacles clearly - the cliff face to the left, the steep slope of the mountain we have been climbing without realizing the incline. In these moments, we recognize the full weight of the load we have been carrying, things that we have willfully ignored, endured, rationalized in the course of everyday life. It was one such moment during my fieldwork in the semiconductor industry that revealed the vast structural inequalities embedded in the globalized circuit of engineering labor and the uncertainties that engineers in this industry lived with, like a fault line awaiting an impending earthquake. A few months after I began my interviews with semiconductor engineers, the industry was rocked by a massive layoff in the Northeastern region. It’s possible I should have been expecting it. Just days before, my friend and research participant, Xiaoli (F, 35, China), had confided in me the rumors swirling around the office. An ominous development had occurred which rung alarm bells for many employees at the company. “They have reserved all the conference rooms on the first floor,” Xiaoli said in a low worried voice. That was what happened last time. “But there was just a layoff earlier this summer,” I reassured her. “Surely it won’t happen again so soon.”

I had been working as a yoga instructor in the onsite fitness center at a semiconductor company for several years by that time. My class schedule was typically early in the morning, the first yoga class at 6:30am, the second at noon. Typically, when I arrived at the sprawling campus-style manufacturing site in the dark early hours of the morning, there was no one else around. At 5:45am, most first shift workers had already arrived, but third shift workers had not yet left. Professional staff would not trickle in until 7:30 - 9:00am. Usually I made my way blearily into the building alone, encountering no one. This day was different. As I walked the
familiar white fluorescent hallways, I passed several security guards heading into a first floor conference room. Peeking inside on my way past, nearly twenty guards had gathered for what I assumed was an early morning training, all dressed in dark pants with grey polo shirts. It should have been a warning, but in the mental fogginess of early morning I had not yet put the pieces together.

The morning passed quietly for me. The fitness center is a quiet place, sheltered from the bustle of daily activities happening on the floors above. However, by noon, the turbulence occurring outside our doors began to spill inside as students arrived to noon yoga heavy with fear and sadness. “They’re laying people off today,” David (M, 39, White American), a long-time student, told me somberly. In addition to fear for their own jobs and sadness for their peers, my yoga students were also shocked at the way the layoff was conducted, a process that was perfunctory and abrupt, and which many employees perceived as unusually cruel. By the time the professional staff arrived to work, security had been deployed to monitor every hallway, every elevator, every conference room. Waves of employees were sent to first-floor conference rooms, at 9am, at 10am, at 11am. Managers were laid off in the afternoon, sometimes after having supervised their direct reports’ terminations. All told, over 200 employees were terminated in a single day.

At an afternoon all-hands meeting, the company leadership team announced a strategic shift away from “bleeding edge” technology, necessitating the elimination of workers associated with research and development (R&D) divisions of the company. “Bleeding edge” is a term in the tech industry to indicate extremely new and risky technologies. Similar to the “cutting edge”, the bleeding edge indicates a high payoff but the potential for getting burned. In semiconductors, it is also a reference to technologies whose dimensions are so miniscule that they do not obey
expected physical laws. Even the edges of these tiny devices are unstable – instead of fixed boundaries, they blur and bleed. This company found itself on the razor edge of risk – although it had taken a leap in investing in new technologies, it was now time to scale back. It was necessary for the long-term health of the business, the company leaders told reporters concerned about local jobs. Production on the “bleeding edge” had grown too expensive and only promised to consume more resources. They needed to go back to the basics. There was still plenty of market share in more established technologies, even if the potential payoff was not as high. Company leaders reassured their unsettled employees that there would be no further layoffs, but employees were not sure whether to believe them. After all, this had happened just a few months before, and there were troubling examples of other locations globally who had not recovered after similar strategic moves, leaving behind only skeleton crews to keep the manufacturing floor running.

In the following weeks, those of us who remained would take stock of those who had been let go and who remained. I lost a number of regular yoga students that day. It was as if they had simply vanished, with no goodbye and no forwarding address. Sharat, with his clumsy sun salutations and mischievous smile. I saw him for the last time as I walked out to my car the day of the layoff. He waved at me brightly as I passed. Priya and Vanessa, the inseparable pair, who always arrived to class together. I heard much later that Priya’s visa had expired before she was able to find a job in the U.S., so she had taken a job in the financial sector in Mumbai. For a while, I greeted every yoga student with joy and relief, grateful to discover they were still there. Some employees begin to compile lists of those who were laid off - perhaps to remind them to follow up to say goodbye, or perhaps simply as a record, a memory, of who was lost. For my part, when emails bounced back indicating the accounts had been terminated, I made my own list, in part as a way of processing my sadness, and in part as a document to remember the bright
faces who had once graced my classroom. Healing after such a traumatic event takes time. For months afterward, the remaining employees felt unsettled, even betrayed, by this course of events. Conspiracy theories circulated about additional layoffs, potential buyouts, mergers and restructuring. Employees continued to trickle out of the company, voluntarily finding new positions, convinced that this site was on a downward trajectory and trying to hedge their bets. It was not until nearly a year later that a sense of normalcy and security began to return.

Layoffs like this one, I learned in the coming weeks, are not altogether unusual in the advanced manufacturing sector. As advanced technologies develop at a rapid pace, companies balance the need to stay at the cutting edge of technological development with the profitability of more reliable, established technologies. It is common for companies to invest in R&D for a short period of time as a strategic priority to stay ahead of the curve, hoping for big payoffs in exchange for high risk, only to change course a few years down the road to focus on more reliable products with moderate profits and less risk. When these strategic shifts occur, departments that house R&D efforts expand and contract, and highly skilled professional workers are hired and laid off accordingly. One of my participants described this process within companies as being “like breathing”, happening in most companies fairly regularly and serving a dual purpose as a filtration system for collecting employees they feel are highly competitive and shedding those who are deemed to be “not a good fit” for a host of possible reasons. In large layoffs like the one described above, the filtration process becomes less refined - competitive employees are expelled along with the rest in the company’s effort to rapidly downsize.

When I entered the field, I did not expect to study the dynamics of a globalized labor force. I had intended to conduct a relatively narrow study of gender and racial/ethnic inclusion amongst engineers in the workplace. I had kept my framework purposely broad, in keeping with grounded
theory methods, but had prepared to focus on internal corporate policies, mentoring, and interpersonal relationships, and how these factors influenced employees’ sense of belonging at work. However, I had also made a commitment to intersectional studies of gender and deliberately sought out women of color to understand how their experiences differed from those of white women in engineering, about whom much of the existing literature is written. It was these conversations with women of color, many of whom were migrants from East and South Asia, that made it clear that a major component of their feelings of exclusion and isolation were related to their migrant identities, pulling me into a much larger conversation about global migration and neoliberal flexibilization of labor.

Moments of crisis often highlight the boundaries, fractures, and conflicts within communities, and in this way, the layoff described above was clarifying in terms of understanding the obstacles to belonging experienced by migrant engineers. It is difficult to feel as if you belong (in a city, in a company, on a team) if your life is upended by layoffs every five years. It is difficult to feel completely settled when your family lives overseas, or if your visa is set to expire next year and you’re deciding whether you want to stay or return home. For women, in particular, the pushes and pulls of the labor market are experienced differently than men. While men are drawn into high-skilled professional migrant labor through pull forces, women are more typically pushed into family roles and have to fight to stay in careers like engineering, particularly when these careers require the flexibility to migrate nationally and globally. Therefore, while this dissertation does retain significant discussion of internal workplace dynamics in later chapters, to fully understand underrepresentation of women in the male-dominated field of engineering, it is important to also understand the global labor dynamics that these companies and employees operate within. This wide-angle lens has revealed the steady
creep of neoliberal flexibilization amongst the professional and managerial classes, a process that in its intensive focus on self-discipline and individual achievement has undermined workers’ sense of stability, which derives from collective constructions of family, community, and long-term personal relationships. Unmoored from these foundations, it largely falls to women to patch together the fraying, threadbare fabric of belonging on the integrated circuit. For women engineers, this means walking a thin line between doing what it takes to stay competitive in their careers and making sure their families retain the comforts of home, security, and normalcy in an increasingly destabilized world.

**Semiconductor Manufacturing**

I conducted my fieldwork amongst engineers working in the advanced semiconductor manufacturing industry in the Northeastern United States from May 2018 - Sept 2019. The field of semiconductor engineering is a global industry that requires a highly educated, specialized, and mobile workforce. There are a limited number of locations around the world where integrated circuits (abbreviated as “ICs” or simply referred to as “chips”) are designed, manufactured and packaged for use in electronic devices, such as cell phones, computers, game consoles, automobiles, and other applications.

I have borrowed the phrase “the integrated circuit” from Grossman (1980), who used it as a play on industry-specific language to refer to the seamless flow of labor, a current in a closed loop, that directs people, goods, and processes around the world. In this dissertation, it refers to engineers who navigate the global labor market at a higher level of prestige and privilege than the factory workers that Grossman studied. In this sense, the phrase also serves as a reminder of engineers’ embeddedness in a global labor market that has historically relied on the unseen, repetitive labor of low wage women in electronics manufacturing overseas. At the time of
Grossman’s writing, single women were hired on factory floors in East and Southeast Asia for their obedience, excellent eyesight, and low wages. Women who got married were expected to quit or be fired. If they suffered injuries on the job, they were not compensated. Women’s labor in Asia was used to justify low wages and ensure compliance from Native American women working in factories under similar conditions on the U.S. West Coast (Nakamura 2014). If electronics workers in the U.S. demanded better wages or benefits, they would be threatened with job loss to Asia. Eventually, the factories were outsourced anyway, leaving a gaping hole in the economic stability of Native American communities in the American Southwest. The invisible labor of low-skilled factory workers continues to be required for devices we use every day - cell phones, tablets, and computers. Referencing Haraway’s “Cyborg Manifesto” (Haraway 2013), Nakamura writes, “some must labor invisibly for others of us to feel, if not actually be, free and empowered through technology use” (Nakamura 2014:919).

Fast forward nearly four decades later, semiconductors is a $449 billion market worldwide (Liu and Duhalde 2018), and design and manufacturing are spread across the U.S., Europe and Asia, with different parts of the process outsourced to countries where manufacturing and labor are cheaper (Liu and Duhalde 2018). There are three major stages of production: 1) research and development (R&D), 2) manufacturing, and 3) packaging and testing. R&D is typically done in wealthier nations that have invested significant resources in education and technological development: the US, Europe, Japan, South Korea, and Taiwan. Manufacturing is more widely distributed across the US, Europe, East Asia and Southeast Asia; difficult processes are housed in hubs where specialized workers can be found, while more routine processes can be performed in locations with cheaper, unskilled workers. Packaging and testing is also fairly routine work, typically outsourced to locations where labor is cheaper, often in East and Southeast Asia.
Competition amongst nations for supremacy in the semiconductor market has led to hostile relationships - particularly between China and the U.S. - and accusations of intellectual property theft across national borders (Chu 2013; Tinn 2011). Despite holding the vast majority (46% in 2017) of the world’s semiconductor market share (Liu and Duhalde 2018), the U.S. conducts semiconductor design and manufacturing in only a handful of locations, most of them on the West Coast, outsourcing most routine processes overseas. The pocket of semiconductor companies in the Northeastern U.S., where my research takes place, is an anomaly, yet it attracts highly specialized migrant labor from around the world.

Semiconductor engineering companies rely on migrant engineers with specialized skills, most heralding from India, China, and South Korea. Engineers in this industry can be largely classified into three functional groups: manufacturing, design, and integration. Manufacturing engineers supervise the manufacturing process and monitor quality control. Design engineers create new chip designs to meet customer specifications. Integration engineers serve as an interface between the customers, who place orders for particular chip functions, and the design and manufacturing engineers to ensure that chips meet certain manufacturing parameters. Most engineering roles in the semiconductor industry require at least a master’s degree, either in nanoscale engineering or a related field, such as chemical engineering, electrical engineering, or materials science. Frequently, companies will hire employees with PhDs in chemistry or physics to apply their theoretical knowledge in the “applied” setting of engineering. Arguably, the most prestigious engineering work is in R&D, in which engineers endeavor to reduce the size of ICs to ever more minuscule dimensions and improve the reliability of manufacturing at smaller sizes. Engineers who are drawn to innovation at the “bleeding edge” chase this technology around the world, as it shifts from location to location.
Methods

I stumbled into this field site almost by accident, following a string of disappointing attempts to research engineers working industry. It is extremely difficult to get access to a corporation for research in the United States, as many companies are wary of potential legal implications and/or damage to their public image. Ethnographers whose observations will directly improve corporate profitability (i.e. production improvements) are more likely to receive permission for research, while those who are conducting critical inquiries are less likely to receive approval (Alcadipani and Hodgson 2009). In my case, as a scholar hoping to study diversity and inclusion in the workplace, my research topic was perceived as too risky, potentially opening the corporation to legal liability. The timing of the topic was also an obstacle - my research took place shortly after the tumultuous #MeToo movement in 2017, a time of heightened public attention to sexual harassment in the workplace. I contacted many companies in the area, hoping they might see my research project as an opportunity to be proactive about addressing unconscious biases. Unfortunately, my requests were either denied or quietly ignored.

The difficulties of access present a dilemma for corporate ethnographers, whose chief advantage is their ability to gain an “insider” perspective. The traditional ethnographic approach follows methods established by early anthropologist Bronislaw Malinowski (1922), in which the anthropologist lives and works for at least one year in the community studied. Anthropologists may devote several years and multiple visits to a single field site. By prioritizing depth of immersion, anthropologists gather deep understandings about community culture and the beliefs and rules that govern members’ behavior. Although time consuming, the benefit of ethnography is to provide a first-hand account of personal experiences in the community, as opposed to second-hand interview accounts that may be filtered through subconscious cultural lenses. The
resulting ethnographic work provides a “thick description” of not only what was said and done during the period of research, but the deeply held beliefs and interpretations of what these events mean to the community. To illustrate the necessity of “thick description”, Geertz famously explained the difference between the twitch of one eye and a wink (Geertz 1973:5-9). A wink is imbued with meaning, while a twitch is an involuntary muscle spasm. A skilled observer can tell the difference, and furthermore, can interpret what the wink means. There are several possible interpretations - it may be a light-hearted gesture or a threatening one, a joke or a signal calling them to action. Interpreting the wink requires careful observation by a researcher who is familiar with the context in which the wink occurs. This is the central goal of an anthropologist - to observe commonplace behaviors and events and understand their meaning and importance in the community.

Traditional ethnographic methods are becoming increasingly difficult in the modern era, when community boundaries are less fixed and more mobile (Hannerz 2006; Coleman and Collins 2006). Malinowskian-style immersion becomes complicated when the community studied is not bounded by geographic location, as is the case in many migration studies. For researchers who “study up” - an anthropological term for studying upper levels of the social strata (Nader 1972) - the research participants are less likely to even perceive of themselves as a bounded community, but more as a loose collection of individuals. In these cases, it has become difficult to define “the field”. Multi-sited research methods (Marcus 1995) have gained popularity over the past twenty years, permitting researchers to follow flows of people or resources as they traverse between multiple field sites; however, significant tradeoffs must be negotiated between depth (how long in one place?) and breadth (how many places?). Furthermore, concerns have been raised over the pre-scheduling of observation and interviews,
which have been largely driven by participants’ expectations of courtesy (Hannerz 2006:34). Referred to disparagingly as “anthropology by appointment”, some anthropologists question whether informants will change their behavior if they are prepared for the anthropologist’s arrival, indicating that the researcher is not truly getting the “insider” perspective. Hannerz (2006) argues that this is a particular problem for those who “study up” since people at upper levels of society (such as executives and engineers) are frequently accustomed to budgeting their time efficiently and have greater power to limit or refuse continuous observation.

In the field of corporate ethnography, traditional Malinowskian-style access is almost impossible to achieve. As a result, the majority of the ethnographies written about corporate life are primarily interview-based, attempting to offset lack of access with a high volume of interviews with employees in the company (Ospina 1996; Morrill 1995; Smith 1992; Jackall 1988; Burris 1983; Jackall 1978). A few studies were lucky enough to collect 2-3 weeks of observation in limited scenarios, but this was only granted after significant rapport was established. In an attempt to preserve the depth of ethnographic research, a few researchers chose to conduct research covertly after having been hired into lower-level positions, giving them the desired “insider” perspective (Ho 2009; Pierce 1996; Burawoy 1985). However, while there are situations wherein covert research is permissible in fields such as sociology and journalism (Gusterson N.D.), the practice is not sanctioned in anthropology and I did not wish to begin my career by breaking with the ethical norms of my discipline.

Anthropologist Hugh Gusterson (Gusterson 1997; Gusterson N.D.) wrestled with similar obstacles throughout his research career on the margins of the nuclear weapons industry. Gusterson conducted his first ethnography without full access to the weapons facility he studied, embedding himself instead in the wider community surrounding the facility. He contends that the
combination of interviews, community observations and document analysis provided him with the “thick description” he was looking for (although he acknowledges that other anthropologists may not agree). He further argues that projects that “study up” will likely benefit from “polymorphic engagement” (1997:196), meaning the triangulation of many different source materials, to get around problems of access. This became the approach I adopted to study the world of advanced manufacturing.

By coincidence, I had been working as a yoga instructor at a semiconductor manufacturing facility for nearly three years. As a former engineer who had worked in industry for several years before returning to grad school, I was a good fit for communicating the goals of yoga to engineers in a way that felt authentic and beneficial to their lives, and I developed a strong rapport with my yoga students. When I put out a general call for research participants working in engineering industry, many of them volunteered to be interviewed for my study. At first, I interviewed widely with many companies and industries in the local area. After my first several interviews, I quickly realized that cultural norms vary significantly between industries and between companies. For example, in semiconductor manufacturing, engineers are highly specialized, most have upper level degrees, and may work in either an office or cleanroom environment. In building systems engineering, by contrast, most engineers have broad general knowledge, are hired immediately after receiving a Bachelor’s degree and alternate between computer-aided drafting work in an office and fieldwork at construction sites. Given the variety in specialization and work environments, it was difficult for me to characterize a consistent nature of “engineering culture”. I found that my network was particularly dense in semiconductors and decided to narrow my focus to the semiconductor industry. By narrowing
around a single industry, I felt I was able to engage more with the specific contexts of the global market and workplace cultures to develop a richer ethnographic picture.

Over the course of 18 months, from May 2018 to Sept 2019, I conducted a polymorphic study of the semiconductor community in the Northeastern United States. I collected 38 life history interviews with semiconductor engineers from three companies, hailing from 11 different countries, and speaking 13 different native languages (see Tables 1 and 2). Women were intentionally oversampled, resulting in 24 interviews with women and 14 with men. Ages ranged from 23 to 56 years old. In addition to the life history interviews, I also conducted long-term participant observation with 17 families (approx. 85 total visits), either in their homes or informally over lunch or coffee breaks, learning more about their everyday work schedules and issues they were concerned about in work and family life through repeated follow-up visits.

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I was also able to negotiate access with regional networks for women in engineering and attended several events for observation and recruitment. I simultaneously monitored local and national news pertaining to the semiconductor industry and high-tech immigration. Finally, my status as a yoga teacher in a semiconductor company helped me stay abreast of the everyday bustle of semiconductor work life and events that mark the corporate calendar, including company-sponsored family movie nights, summer barbecues, technical conferences, and women’s networking events. I was careful to avoid conducting research on company premises, since I did not have permission to do so. However, while my position in the fitness center was isolated from the everyday work processes that occurred on the floors above, I found that by simply being present throughout the course of the year, I was able to gain insights into the flows of work in this industry and some of the intangible, environmental elements of corporate culture that are difficult to capture from interviews alone.

Given my research interest in intersectionality, I purposely oversampled women and people of color, seeking interviews with male and female immigrants from a variety of nationalities and ethnic backgrounds, from countries with both well-established migration patterns in high tech labor, such as India and China, and from countries with less frequent migration, such as Bangladesh. I ended up with a data set that provides a nice cross-section of a multicultural workplace, including insights into Chinese, Indian, and European social networks. While this data set is substantial for a qualitative study, given the diversity of the population it is still too small to generalize to the entire semiconductor population in this area, and thus my description of events in this industry should be interpreted narrowly. I acknowledge there are populations that are missing from this study, including a substantial Korean community.
Furthermore, as a white American researcher, it was sometimes difficult to communicate across ethnic, linguistic and national boundaries - I did my best to draw out detailed descriptions of things I did not yet understand and to follow up with additional independent research into histories and policies that were unfamiliar to me. However, anthropologists often insist on communicating with participants in their native language, asserting that significant meaning is lost across language barriers (Foley 1997; Becker 2000; Becker 1993). This would have been very useful particularly in my interviews with Chinese participants, who often had difficulty expressing themselves in English.\(^1\) In addition, all social research takes place within pre-established power relationships and rapport is easier to build when researcher and participant share a common background, whether by gender, social class, and particularly racial/ethnic group (Bhopal 1995; Gwaltney 1980). Fortunately, some studies have shown that these are not insurmountable obstacles (Andersen 2011; O’Brien 2011; Williams and Heikes 1993). Anderson (2011) finds that it helps to trigger discussion of political and/or controversial topics, such as racial and gender inequality and discrimination, with concrete examples during the interview. By breaching the topic specifically, the researcher demonstrates their understanding of the issue and indicates that racism and sexism are safe to talk about. I used this technique frequently during my interviews as a bridge across racial/ethnic/national divides. In addition, my status as a woman and former engineer positioned me as a person who understood many issues that women faced in a male-dominated workplace and I was able to build rapport along those lines of shared experience. Despite the study’s limitations, I feel that I have captured the beliefs and value

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\(^1\) All interviews in this study were conducted in English. If I could do it again, I would conduct interviews with Chinese participants in Chinese, either by learning myself or using an interpreter. I am currently learning Mandarin independently in case it is useful in the future. My Indian participants’ native languages were varied - Tamil, Telugu, Marathi, Urdu, etc. They had little difficulty expressing themselves in English, so this was not as much of an issue.
systems that characterize the culture of the global semiconductor industry and provide a window into the benefits and challenges of this multicultural high-tech workplace.

The discipline of cultural anthropology, as a discipline that frequently studies marginalized populations who may be negatively impacted by careless research practices, is committed to protecting the anonymity of research participants. All participants’ names have been changed; at times I have scrambled identities. I have done my best to ensure their identities cannot be triangulated from their descriptions. This study included participants from three semiconductor companies in the region. Although the company culture was slightly different at each location, to maintain the companies’ anonymity I have chosen to combine elements of each to produce a single conglomerate portrait of semiconductor workplace culture. This follows common ethnographic practices of anonymizing business entities (Amrute 2016; Kunda 2009; Hochschild 1997; Zussman 1985). Although I do describe specific events that occurred during my research, such as the aforementioned layoff, my understanding of these events is that they are common industry-wide and not practices specific to particular companies. I hope that by declining to attribute events to specific institutions the risk to the companies’ public reputations will be sufficiently diffused. I would also like to highlight a fundamental difference between the aims of anthropology and the field of investigative journalism. While one of the goals of a journalist is to hold powerful institutions accountable, as an anthropologist and social scientist, my goal is not to write an expose, but rather to understand the larger systems that companies operate within. Therefore, my work is focused on broader issues of neoliberalism and systemic inequalities (global, gender, and racial/ethnic) and how these manifest in the workplace - issues that are widespread problems that might be found in a number of similar companies in the U.S.

Selected Terminology
Throughout this work, I have wrestled with the question of how to refer to my research participants in written materials. Anthropologists have long debated the benefits and drawbacks of terms such as “informants”, “interlocutors”, and “participants”. In this study, I have chosen to use the term “research participants”. I feel this reflects both the academic purpose of the study and the agency of engineers in choosing to participate. The term “informant” is commonly used in anthropology, but has a negative association with spying that I felt was counterproductive in a study which was often confused for investigative journalism. The term “interlocutor” is used frequently by anthropologists studying marginalized groups in an attempt to equalize the power dynamic between the researcher and the researched. In this study, I did not feel this was necessary, since the power dynamic between myself and my informants was relatively balanced. Although many participants were vulnerable to the U.S. immigration system, all were highly educated, lived comfortably, and were well paid, and several were in high ranking positions in their companies. In addition, “interlocutor” suggests that the purpose was merely conversational, which disguises the intent of the conversation; all of my participants, being engineers with research experience themselves, understood that our conversations were specifically to contribute to my research. With that said, I have established real friendships with many, which I hope will endure beyond this research project. My life is richer due to their willingness to share a portion of their lives with me.

Another terminological debate arose in the selection of a term to refer to their status as workers in a global labor force. In a multicultural setting such as this one, it was difficult to find a term that is sufficiently broad to include all participants, yet also retain specificity. In many migration studies, the research subjects share a common racial, ethnic or cultural background that allows the researcher to easily refer to their subjects as a group (i.e. “Chinese”),
“Bangladeshi”, “Bengalis”, etc.) This was not possible in a multicultural setting like semiconductors where workers hail from a multiplicity of national and cultural backgrounds. In trying to characterize the group broadly, I tried to focus on their shared status as engineers and migrant workers; however, even here there are critical distinctions. In anthropological textbooks, an “etic” distinction is made between “immigrants” who move to a new nation permanently, and “migrants” who move temporarily, but intend to return home. In semiconductors, there was a good mix of both migrants and immigrants. Furthermore, many engineers’ intent to return to their country of origin was a flexible, situational desire. After the layoff, for example, some migrant workers who had intended to stay in the U.S. felt unsettled and debated whether to return home and find work closer to their families. Even if a person indicated their intentions to stay or return directly, those intentions might change over the months of research, or in the years to come. In addition, an “emic” category emerged, primarily amongst American and European migrants, who referred to themselves - “ex-patriots” or “expats”. This is a term rooted in colonialism with embedded power dynamics: “expats” are from Western countries who have either permanently moved abroad or work and live abroad long-term. Edward Said’s (2003) theory of Eastern/Western dualisms was clearly visible in the dichotomy between Western “expats” and Asian “immigrants”.

In the end, I chose to keep my terminology as broad as possible, using the term “migrant worker”. This term also has its problems - it has been associated with low-skilled migrant labor, which in the U.S. usually refers to Latin American populations; high-skilled workers may feel this term diminishes their status. However, it allowed me to avoid uncomfortable attempts to guess at an engineer’s intention to stay, or even to treat that distinction as a category that mattered. For most, in relation to their employment, to stay or to return was a desire that
fluctuated depending on their employment circumstances. It also enabled me to avoid colonial terms that distinguish between Western and non-Western migrants and class distinctions between low-skilled and high-skilled migrants. Finally, I will note that there were several Americans in this study who grew up in the Northeastern United States and had no intention of migrating. I note that distinction where it arises, while also maintaining that migration - whether internally or globally - is always a possibility in semiconductors, and often a necessity.

**Contextual Literature Review**

This study begins and ends with belonging, specifically why belonging seems to be so difficult to achieve in engineering for minority “others”. This is a question that has long perplexed me, as a woman and former mechanical engineer myself. After graduating with my engineering degree near the top of my class, I worked in the aviation and building construction industries for over seven years as an entry-level engineer. Despite always being a high-achiever, throughout my short career I felt as if I was fighting a constant, ongoing battle for the right to exist as myself in a discipline that was made up of so many people who were so different from me. Having never taken gender studies or social science courses in college, I did not have the language to describe my frustration at the time. All I knew was that, whether I liked it or not, I had found myself abruptly entrenched in the middle of a decades-long fight for women’s equality in the workplace and that as much as I might want to live a normal, peaceful life, there was no place for reprieve. The workplace was a metaphorical war zone and every day was a new battle to be recognized as a legitimate, “good” engineer, which seemed to conflict with being a woman. In part, this dissertation has been an effort to characterize what it means to belong in engineering and to clarify the subliminal boundaries of membership that had eluded me in my former career.
In order to build a holistic concept of belonging in engineering, I drew from several disciplinary backgrounds. My point of origin is anthropology, with its rich foundation from which to study belonging and membership, migration, and labor. Feminist studies and intersectionality theory have overlaid these foundations with an understanding of how social systems, such as labor, are gendered and racialized, often directing specific demographics to different segments of the workforce. Anthropological studies of gender and work further clarify that these divisions of labor are culturally constructed and are not uniform across national and cultural boundaries, undermining essentialist arguments that there are biological differences in work preferences and abilities between men and women, or between racial/ethnic groups.

Finally, the field of science and technology studies, and its subfield of engineering studies, have provided critical insights into the complexities of engineering culture, its historical context, and its intersections with gender and race. Given the complexity of this framework and the difficulty in choosing a point of departure, I will begin with a brief summary of the engineering studies literature and how my fieldwork in semiconductors conforms and departs from similar studies of engineering culture.

Engineering, in contrast to their “purist” scientific predecessors, has often been classified as an “applied science” that is aligned with, and some would claim inextricable from, business interests. Historically, engineers belong to three major branches: 1) the civil engineers who labored on government projects, such as railroads and canals, 2) the mechanical engineers who differentiated themselves from craftsmen and mechanical trades by way of acquiring scientific knowledge, and 3) the electrical and chemical engineers, who were originally trained as scientists, but crossed the academic boundary into industry projects (Noble 1977:35–38). By distinguishing themselves from both business and labor, engineers have positioned themselves as
the ultimate experts in technical processes in government and industry. While engineering
disciplines have compared themselves to other professions, such as medicine and law, they have
struggled to retain full autonomy over their labor. Although engineers claim control over esoteric
engineering knowledge, they accept direction from management regarding the products and
purpose of their work (Layton 1971). Through their work in industry, engineers have been the
masterminds behind corporate efficiency practices and were responsible for the creation of
scientific and personnel management processes (Noble 1977). A subset of engineers has long
argued for greater autonomy from industry goals, asserting that engineering could retain greater
autonomy by maintaining a stronger ethical practice guidelines and a mandate to privilege public
service over private profit (Wisnioski 2012; Layton 1971). However, these movements have had
difficulty breaking through, leaving engineers beholden to corporate interests; as Wisnioski puts
it, the “system builders” have become “servants of the system” (Wisnioski 2012).

Culturally - at least in the U.S. - engineers are stereotyped as hyper-rational and anti-social,
often referred to as “geeks” and “nerds”. These identities were products of Cold War-era
education and workplace cultures, a time period when a high proportion of engineers were
employed on government defense projects such as nuclear weapons, advanced aircraft design,
and space missions (Wisnioski 2012). As a result, the Grinter Report (Grinter 1955) changed
engineering curriculum to rely heavily on theoretical physics, downplaying both the acquisition
of “hands on” skill and the role of social and interpersonal skills. Subsequent reports since the
1970s have noted the need for improvement in engineers’ understanding of social and political
directors, including the Future Directions for Engineering Education (CPA 1975), NAE’s
Engineer of 2020 (NAP 2004), and Boeing’s The Global Engineer (Boeing and RPI 1997).
Separately, the “hacker” identity was forged in the 1970s at elite institutions such as Stanford, in
which engineers would pull all-nighters in super-computer labs, engaged in extracurricular coding competitions (Ensmenger 2015). These engineers’ lack of interest in hygiene and social niceties contributed to modern caricatures of skinny computer nerds eating fast food in their basements while playing World of Warcraft. While the “geek” identity continues to resonate in popular culture, it does not accurately describe engineers in practice. Tonso’s (1998) study of college-level engineers found three resonant identity types: “Nerd” was indeed one recognizable identity, characterized by antisocial behavior, but there were also more well-rounded “Academic Achievers” and highly social “Greeks”, referring to fraternity members. Faulkner’s (2009a) study of masculinities in engineering reveal a wide range of potential identities, including “nuts and bolts”, and “football and families”. Studies of workplace culture in engineering reveal crucial class differences between blue- and white-collar work cultures (Faulkner 2009a; McIlwee and Robinson 1992), in which blue collar work environments are described as blunt and confrontational, while white collar office work cultures are more “genteel” and respectful. Such class distinctions often map onto technological development, with blue collar work residing in older, more established manufacturing sectors and white collar work often takes place in sectors in which there is more rapid technological advancement.

For all the variation in engineering identities and cultures, the discipline remains steadfastly male-dominated. This is partially due to engineering colleges’ late start in recruiting female students. By the women’s rights movement of the 1960s women had already been admitted in significant numbers to degree programs in “pure” sciences, such as biology and physics; however, in engineering women had been notably absent (Rossiter 2012:Fig 3.2). For comparative purposes, in 1970, women’s enrollment in other scientific disciplines totaled nearly 80,000; in engineering, fewer than 90 women were enrolled nationwide (Rossiter 2012:42–44).
The mission to recruit women and minorities for engineering degrees was initiated by corporations, who were experiencing a shortage of engineering labor and pushed universities to widen the pool of potential applicants (Rossiter 2012). Simultaneously, government programs in the wake of the women’s rights and Civil Rights movements sought to prevent discrimination and promote the advancement of women and racial minorities. Coalitions between industry, government and higher education produced a rapid increase in female graduates between 1975 and 1985; however, these initial gains have stalled and women’s enrollments have hovered at 20% since the 1990s (NSB 2018). Racial minorities have also struggled to achieve equal representation in engineering; the percentage of bachelor’s degrees awarded to Hispanic, Black and Native American students remains in the single digits and minority women are far less likely to earn engineering degrees than white women (NSF 2015).

A common explanation for why there are so few women in engineering follows the thinking of former Harvard President Lawrence Summers, who once blithely asserted that women and minorities’ persistent underrepresentation is due to lack of aptitude, interest and commitment to their careers (Jaschik 2005). However, scholars of science and engineering maintain that systemic discrimination and hostile disciplinary cultures are to blame. Some have highlighted the role of scientific professional organizations in crafting and controlling membership guidelines, such as qualifications, training and performance, that implicitly exclude women and racial minorities (Noble 1992:274). In engineering, university admissions screen applicants based on math eligibility and standardized test scores, which disadvantages students with less access to quality high school education, effectively privileging white middle class students (Slaton 2010). The concept of “rigor” in engineering has been a frequent tool for maintaining the status quo (Riley 2017; Cech 2014; Cech 2013; Slaton 2010), with its proponents shutting down
propositions of cultural change with accusations that such changes would diminish the academic integrity of the discipline. Engineering departments have resisted remedial math and science instruction and more inclusive admissions criteria, while affirmative action policies are frequently dismissed as “favoritism”, in a flawed belief that women and minority students and faculty are enabled to sidestep rigorous, meritocratic competition. This is disappointing, because some evidence suggests that Equal Opportunity Employment laws and affirmative action have been effective for promoting women’s advancement. In industry, McIlwee and Robinson (1992) find (somewhat counterintuitively) that women tend to be more successful in firms where there are layers of management and bureaucracy, often due to affirmative action laws that are required to compete for government contracts. In contrast, in firms with less hierarchy, in which engineers retain significant control over the culture, women report high levels of job satisfaction but are less likely to be promoted due to peer biases.

In addition to these systemic forces that resist women’s and minorities’ success in the field, engineering workplace cultures are prone to gender-based dualisms that position feminine traits (i.e. social skills, emotional intelligence, collaboration) in an inferior relationship to masculine ones (i.e. technical skills, unvarnished facts, solo work) (Faulkner 2009a; Faulkner 2009b). Masculine/feminine binaries exist mostly as imaginaries which tend to disintegrate upon close inspection, but are nonetheless powerful symbols that signal a close alignment between core engineering values and masculinity. While Faulkner (2009a) has observed that gender dualisms have a notably strong resonance in engineering culture, they are in fact a central organizing principle that underlie nearly every social institution and vary with context. Western scientific disciplines are rife with such dichotomies that position women as inferior practitioners of science. Noble (1992) has argued that scientific discovery was contingent upon an absence of
women, who were perceived to be a polluting source of temptation in the ascetic, clerical origins of early scientific practice. Similarly, amongst 19th and early 20th century scientists, women’s obligations to, and implicit associations with, family and domesticity precluded their recognition within several scientific archetypes of the time: purist, explorer, martyr, and barbarian (Herzig 2005). Women, at that point in history, were viewed as not sufficiently dedicated to scientific pursuit and incapable of the voluntary suffering required in the service of science.

Gender dichotomies differ by culture and are reinterpreted and reinvented from generation to generation. For example, contemporary American perceptions that women have inferior technical and spatial capability (Ortner and Sieverding 2008) is not consistent across cultures (Varma 2017) and it has shifted over the last decade to resonate less with younger generations in the U.S. As I will discuss in Chapter 4, American engineering culture itself is in the midst of a decades-long effort to become more collaborative, incorporating social, organizational, and teamwork skills that previously fell under the domain of “femininity”. Smith Rolston (2014) has observed similar shifts in the mining industry, in which women have endeavored to draw upon traditionally-feminine traits of care to position themselves as “safe and caring” machine operators, in contrast to the rough-and-tumble masculine identities that pervade the mining industry. However, the relationship of masculine dominance endures, Bourdieu argues, through perpetual “labor of eternalization” (Bourdieu 2001:vii) in which men and women reproduce dualisms subconsciously, frequently with no ill will or awareness, through their everyday actions. Via these “constant imperceptible calls to order” (2001:58), women are continually reminded of their subordinate status and men are reassured that their contributions remain superior. This dynamic contributes to an architecture of inequality, a “structure of gaps” (Bourdieu 2001:66), between the achievements of men and women.
Feminist scholars of work (Pierce 1996; Kanter 1993) have termed this phenomenon “boundary heightening”, in which the bar for success continues to be raised, resulting in persistent structural gaps despite women’s observable progress in male-dominated fields. In Kanter’s (1993) seminal work on women in sales, she observed a tradeoff in women’s acceptance at work: so long as women were conventionally feminine and tolerated becoming the subject of men’s sexual jokes, banter and fantasies, women were able to negotiate acceptance amongst their male associates. Pierce (1996) found similar expressions of the hyper-sexualization of women in her ethnographic work in legal offices, finding that sexual harassment was a frequent occurrence that deflated women’s position in relation to men. Pierce also observed other types of “boundary heightening”: female lawyers had difficulty recruiting clients who preferred to work with men, were constantly confused for paralegals, and were designated administrative tasks like taking notes in meetings. In addition, there were divergent “feeling rules” for men and women in legal offices (Hochschild 2012; Wingfield 2010). While men’s aggression was viewed as an extension of their personalities, women’s aggression was viewed as aberrant and required careful management, either by squashing conventionally feminine traits altogether or developing alternative caring personalities to counter-balance or replace aggressive roles (Pierce 1996). Under these gendered emotional rules, the task of conducting a trial became an entirely different experience for women than for men. In the case of Smith Rolston’s female machine operators, their “safe and caring” identities tended to undermine men’s perception of their technical skills (Smith Rolston 2014).

Engineering culture differs from sales and litigation culture in that aggression and sexual harassment are not as prominent. Although hostile personal interactions and harsh criticisms are doubtless a part of everyday workplace interactions, boundary heightening tends to take place
along other dualisms, such as the previously discussed technical/social binary and the characterization of women as mother and daughter figures (Faulkner 2009b). In Tonso’s (1998) study of Greeks, Academic Achievers, and Nerds, female students were viewed as something “other”, fitting into none of the accepted engineering identities. Tonso notes that women were viewed as either “deficiently women” or “deficiently engineer” (Tonso 1998:15). The class dimension of engineering culture also impacts women’s experiences in the workplace. Faulkner (2009b) contrasts blue collar and white collar work environments, noting that hyper-sexualization of women appears to be more extreme in shop- or field-based disciplines, such as heavy manufacturing, oilfields, and construction sites. She found that women experience less harassment and fewer sexual jokes and innuendos in office- and lab-based engineering environments; rather, women tend to be pushed into familiar roles as daughter or mother figures.

Semiconductor engineering can largely be considered a “white collar” work environment with its origins in the scientific engineering disciplines of electrical and chemical engineering, as opposed to government- and labor-influenced civil and mechanical engineering. While manufacturing is a major function in the industry, it falls under the “advanced” manufacturing category - a high tech form in which the work is performed in clean room environments by robotic tools. Most employees work in office settings and the facilities are new and renovated regularly to keep up with rapid technological developments in the field. Women in semiconductors report high job satisfaction and passion for their careers, while also lamenting the “boys clubs” that remain a significant obstacle to their career advancement (more on this in Chapter 5). However, semiconductors attracts women from around the world, making these workplaces small multicultural microcosms in the predominantly white, suburban neighborhoods
of the Northeastern United States. As such, these women’s stories are complicated by their racial and ethnic identities as well as their experiences with the U.S. immigration system.

Such complexities are best captured by intersectional studies, a theoretical framework pioneered by Kimberlé Crenshaw (1991) that argues that discrimination by gender and race are not simply additive, one layer on top of another. On the contrary, ranked identities such as gender, race, class and nationality, can be perceived as a “matrix of oppression”, within which each individual relates to power differently depending upon their placement within it (Collins 2000). As intersectional scholars (Jordan-Zachary 2007; Hurtado 1989) demonstrate, the combination of race and gender produce markedly different experiences - black women and white women, while both experiencing gender discrimination, experience it in different forms. White women, Hurtado (1989) argues, experience greater protectionism due to their presumed alliance with white men; they are offered economic and social benefits in exchange for their compliance, a relationship of seduction. Meanwhile, Black women receive few benefits of white dominance and, as such, are presumed to be aggressive and hostile, resulting in greater outright hostility toward them, a relationship of rejection. The majority of participants in this study belong to Asian ethnic groups. There is wide variation in Asian ethnic cultures, but generally speaking, middle-class Asian women occupy a middle ground, a grey area between Hurtado’s seduction and rejection. Asians are perceived to be a “model minority” - studious, obedient, docile, and crucially for engineering, good at math (Varma 2004). They receive many benefits of American middle class life, yet are not truly insiders. Asian engineers have difficulty being perceived as leaders and rising to high levels in corporate hierarchies (Tang 2000). Their cultures are caricatured and misunderstood and they are subject to anti-immigrant hostilities from those who claim that immigrants “steal” local jobs (Amrute 2016). During my fieldwork, an
incident that occurred in Kansas City sparked national attention when a White man fatally shot an Indian engineer on suspicion that he was Iranian and had traveled to the U.S. illegally (Stevens 2018). Hate crimes against Asians, particularly those with East Asian facial features, also spiked during the COVID-19 pandemic following accusations that China had intentionally spread the virus (Farivar 2021). Unfortunately, these incidents are not unfamiliar to Asian Americans and immigrants. Furthermore, immigration status is an additional layer of identity that produces different orientations in the workplace. Employees on visas are more dependent on their employers than US citizens and permanent residents. They spend significant time and effort wading through the red tape of bureaucracy, including visa renewals and applications for permanent residency or “green cards”. For many, these concerns dwarf issues of discrimination in the workplace, which to them seem like minor complaints in comparison to their legally-enforced outsider status.

While intersectional frameworks are beginning to emerge in studies of engineering culture, the vast majority of gender analyses center white women’s experiences in engineering, cropping the frame to consider only internal office policies and politics. There is a growing body of literature that is dedicated to the study of African Americans, Hispanic Americans and Native Americans, referred to collectively as “underrepresented minorities”, or URMs, many of which take an intersectional lens and have demonstrated the structural and cultural barriers that these populations face in the discipline (Cantor et al. 2014; Camacho and Lord 2013; Ko et al. 2013; Torres 2012; Malcom and Malcom 2011; Johnson et al. 2011; Hanson 2009). However, Asian women are understudied, in part due to the perception that they are high-achievers in STEM (Ong et al. 2011). There are even fewer studies that mention the impact of immigration status (Roberson Hayes and Bigler 2015). In order to capture these complex facets of my participants’
multiple intersecting identities, I found it necessary to expand my view to include the experience of transnational migration and multicultural relationships at work, and how these impact women’s experiences of belonging and non-belonging in the workplace.

This work draws strongly upon anthropologist Aihwa Ong’s (1999) concept of “flexible citizenship” and transnationality, a theoretical model in which migrant workers retain agency in the process of migration, and yet are never entirely beyond the disciplinary forces of government, labor, and family. Ong contrasts her approach with other theoretical models in U.S.-centered migration studies and diasporan studies whose works often reproduce reductive notions of “core” and “periphery”, “winners” and “losers”, “victims” and “liberators” (1999:9-10). She similarly critiques globalization studies such as Appadurai’s “global flows” of focusing so singularly on local cultural adaptations that the larger dynamics of power, including national, transnational, and political-economic forces, become invisible (1999:10-11). Instead, transnational theory insists upon situating subjects firmly within webs of power that impact the trajectory of their lives, while still allowing for personal agency and the possibility of resistance and subversion. Ong writes: “Flexible citizenship is shaped within the mutually reinforcing dynamics of discipline and escape…Although increasingly able to escape localization by state authorities, traveling subjects are never free of regulations set by state power, market operations, and kinship norms” (Ong 1999:20). This lens clarifies that although we live in an increasingly globalized world, the boundaries of nation-states nevertheless retain significance and interact with foreign governments and global capitalism in ways that shape the lived experience of migrants and non-migrants alike.

Scholars of labor-based migration have remarked upon the gendered transnational flows that direct men and women along diverging global pathways. Engineering, like global finance (Ong
is a male-dominated enterprise that exerts “push” and “pull” factors on men that do not exist to the same degree for women. Rather than pushes and pulls to enter careers in STEM, women are more commonly either encouraged to stay home to care for their families or are drawn into careers that align with gendered notions of women as caregivers. A large volume of research in women’s transnational labor has been dedicated to low-wage domestic labor circuits, with particular emphasis on Latina (Enloe 2006; Cheng 2006; Romero 2006; Hondagneu-Sotelo and Avila 2006) and Filipina migrants (Constable 2014; Lan 2006; Parrenas 2006). Other studies focus on sex work (Nguyen, Sankar Saikia, and An Dao 2009) or transnational consumer markets (Darkwah 2009). Women frequently occupy the most unstable sectors of the labor market and are paid lower wages than men (Seager 2009:72). Their labor mobility disrupts traditional notions of home and family, and requires new conceptions of womanhood, motherhood and the organization of family lives (Mahler and Pessar 2006; Gabaccia 1992; Brettell and deBerjoeois 1992). Women’s participation in migration pathways dominated by men is understudied, yet is a significant battleground for women’s equality.

Perhaps given the increasing numbers of Asian immigrants in high tech, there is a small but burgeoning literature on transnational migration in STEM disciplines. Amrute’s (2016) ethnography of Indian IT workers in Germany highlights the intersections of race and class in the workplace, arguing that while Indians are stereotyped as ideal middle-class IT workers, discrimination related to their ethnic identities results in and justifies their positions in routinized, non-management roles in the corporate hierarchy. Mahler & Chaudhuri (2015) similarly find that Indian communities in Florida occupy a complex middle ground as a result of their transnational experience. In relation to their prior positions in India, they are a part of the elite transnational workforce, earning higher salaries and commanding greater prestige amongst their relations back
home; however, in American contexts, their ethnic identities become a focal point of difference that contribute to their marginalization.

Radhakrishnan (2011) adds gender to this equation, demonstrating that Indian women working transnationally in IT perform crucial work in reconciling their global livelihoods with middle-class notions of what it means to be from a “good background” in India, including maintaining cultural traditions and resisting the deterioration of family life. There are additionally several good studies of Indian women’s experiences adapting to U.S. engineering culture (Varma 2017; Dutta 2017; Dutta 2016), which reveal cultural distinctions between Indian and American gender roles and engineering identities. For example, Varma’s (2017) work on gender and computer science in India attests that rather than women feeling ostracized by the geek/hacker identity that is common in the U.S., women are restricted by patrifocal family structures that pressure them to leave the workforce before having children. Studies of Chinese engineers are less common, although there are a few. Gu (2016) conducted an extensive ethnographic study of Chinese women in STEM working in academic and industry positions in the U.S., noting many of the unique struggles Chinese women face in the workplace, including language barriers and gendered expectations that they will be obedient and reticent. She similarly notes Chinese women’s marginal position in transnational guanxi networks, which are male-dominated and membership is carefully screened through affiliations with prestigious universities. Shan (2012) draws upon Wingfield’s (2010) work regarding “feeling rules” in the workplace, showing how the cultural barriers of feeling are difficult for Chinese women to interpret in Canadian workplaces. This collection of literature highlights the cultural malleability of “engineering culture” across national boundaries, and the difficulties experienced by migrant
workers as they translate and transform themselves while navigating the emerging global high-tech labor market.

Most of the studies above focus on a single racial or ethnic group, which enables them to understand at great depth the cultural transitions between host and home countries. However, scholars of multiculturalism have argued that the lived existence of transnational migrants is increasingly negotiated within communities of mixed racial/ethnic/national backgrounds (Vertovec 2007a; Baumann 1996). Geertz, commenting on the complexities that have arisen with globalization, observed, “…[R]ather than being sorted into framed units, social spaces with definite edges to them, seriously disparate approaches to life are becoming scrambled together in ill-defined expanses, social spaces whose edges are unfixed, irregular, and difficult to locate…Confronting landscapes and still lives is one thing; panoramas and collages quite another” (1986:121). This was certainly the case I encountered in semiconductor engineering, in which migrants’ daily lives included working in a multicultural office setting and living in predominantly white suburban neighborhoods. Ethnographic studies of multicultural spaces are difficult to capture while retaining a sense of anthropological holism, historical and cultural contexts of multiple racial/ethnic backgrounds, and the nuances of structure and agency (Brettell 2013). It is understandable, given the enormity of the challenge, that most transnational studies focus on a single, distinct migrant group for clarity and detail. However, Vertovec (2007b) writes that ethnographic accounts that combine transnationalism within multiculturalism, though complex, will yield exciting developments in the everyday dynamics of diversity.

One such study in the high-tech sector is English-Lueck’s (2002; 2011) analysis of Silicon Valley, drawing upon Taylor’s (1997) theory of “deep diversity” - an acknowledgement of culture as more than the simple celebration of rituals and speaking of different languages, but
deeply held beliefs and power structures that produce complex identities. In Silicon Valley, English-Lueck finds a combination of “deep diversity” and “deep toleration”, particularly amongst younger generations, who in this multicultural region of the U.S. West Coast practice the skills of careful listening and thoughtful reflection as they do identity work across multiple racial and ethnic boundaries (2011). She argues that this kind of diversity is supported by the high level of innovation in the region that sees diversity as a benefit for creativity, creating a mutually reinforcing “double helix” of deep diversity and technical saturation (2002). Both innovation and deep diversity demand high adaptability, generating a variety of trajectories for defining and re-defining oneself; yet these cultural values are grounded to an underlying individualism and faith in meritocracy, in which success is tied to individual career achievement, and in which lack of success is attributed to individual failure (English-Lueck 2011).

My fieldwork site in the Northeastern U.S. differs from English-Lueck’s in important ways - although the workplaces themselves are multicultural and employees take pride in their cultural awareness and fluency, the surrounding areas are predominantly white suburbs, within which old resentments about the ways in which the neighborhoods are changing - including arguments over development and demographics - continue to percolate. As such, the deep diversity that might be found in Silicon Valley is shallower in this context; the sense of multicultural camaraderie is contained mostly within the companies themselves. In the absence of deep diversity in the region, there is a tendency toward “balkanization”, or cultural divisions between ethnic groups, in which each group keeps mostly to themselves. Indeed, my fellow UAlbany colleague, Heidi Nicholls, studied the Indian diaspora in the nearby New York Capital District, reporting on the importance of intra-ethnic communities and cultural festivals, or “Third spaces”, to help new arrivals forge new hybridized immigrant identities (Nicholls 2014). In her
work, English-Lueck asks the questions, “Can the distinctive context of Silicon Valley be duplicated elsewhere? What are the constraints to internalizing deep toleration?” (English-Lueck 2011:104). This work attempts to show why deep toleration has been difficult to achieve in this region by focusing on the obstacles of individualism that permeate transnational engineering labor. Bringing together gender, multiculturalism, and transnational migration in the context of engineering workplaces, my goal is to show how the logics of individualism undermine the sense of solidarity, of belonging to a group, that are critical for creating cultures of deep diversity and inclusion in the workplace, and to show how it becomes the work of women to patch together a sense of community on the integrated circuit.

The Case for Belonging

Engineering has struggled with women’s representation to a greater extent than other scientific disciplines - despite massive private and public investment in recruitment, women’s enrollment and career participation in engineering has barely improved since the early 1980s. Since 2000, women’s graduation rates have leveled off to only 20% and women make up only 15% of practicing engineers (NSB 2018). As an anthropologist, my focus has been on the cultural elements that contribute to this disparity. Namely, is there something about engineering culture that makes it more difficult for women to thrive? One particular qualitative study caught my eye early in my doctoral program: an analysis of why some women stay in engineering careers and other women leave the profession entirely (Buse, Bilimoria, and Perelli 2013). A number of factors were compared, including self-efficacy, self-confidence, and why they had chosen engineering. Most women - those who left, as well as those who stayed - reported experiencing difficulties while working in a male-dominated workplace and conflicts with family life. However, most remarkable to me from this study was that all of the women who left the
discipline said they did not resonate with engineering professional identity. Engineering is perhaps unusual in that the community demands a high level of identification with the profession. Among other things, engineers imagine themselves to be bonded by a common passion for technology, a curiosity about how things work (Faulkner 2009a; McIlwee and Robinson 1992). Personally, as a former engineer who grew up with parents who were accountants, this has always been strange to me. There are many accountants who dislike their jobs and are bored by their work but find acceptance in their companies. Engineering, in contrast, is an example of what Coser (1974) has called a “greedy profession”, in that members are expected to demonstrate a strong commitment to the field, which in this case, requires an intrinsic enthusiasm for technology. This can be difficult for women, who are less likely to resonate with this form of technical curiosity as strongly and are equally likely to report choosing engineering for practical reasons (Mills et al. 2013; McLoughlin 2009; McIlwee and Robinson 1992). As a result, many women are left feeling as if they do not belong, and this belonging carries great importance for being considered a “real engineer”. Another similar study argues that it is this personal experience of belonging or non-belonging that is most determinative of whether women will stay or leave the field, arguing that women work harder to “prove themselves” in order to earn acceptance amongst their coworkers and are prepared to change workplaces if they do not eventually experience belonging (Ayre, Mills, and Gill 2013). It left me to wonder, what does belonging mean in engineering? What does it consist of? In addition to technical identity, what other factors are important and how do we create environments in which women feel as if they belong?

Most popular discussion of women in engineering builds upon the framework of diversity and inclusion. After observing a consistent pattern of employees’ failure to thrive in hostile work
environments, diversity and inclusion professionals have argued that it is not enough to simply hire a diverse team, but that women and minorities must also be included as full members of the workplace. Inclusion has two interlocking components: (1) a need to feel accepted as a member of the group, and (2) a need feel valued for one’s uniqueness and authenticity (Jansen et al. 2014; Shore et al. 2011). This definition suggests that it is not only one’s similarities, but one’s differences that must be valued by the team. Too often, it seems, women and minorities’ differences are things that are required to be hidden, at best deemed irrelevant to group functions, or at worst used to support arguments for why they should not be members in the first place. For example, a female engineer’s facility with “soft skills” is not always perceived as a valuable addition to the group but is rather leveraged to argue that she is not a “real engineer” or used as a justification to load her with low-prestige non-technical work.

The boundaries by which individuals are deemed “members” and “nonmembers” have been a longtime subject of study by anthropologists. Early anthropological studies enumerated membership as a set of formal rules that structure who is considered an “insider” and who is an “outsider”. In Fortes’ (1987) account of who was eligible to become an ancestor in the African Tallensi society he studied, he finds a combination of ascribed and achieved characteristics: must not be an only child, must have taken part in the rituals for adulthood, must have been married and had children of their own, their parents’ death must occur before their own. In order to become an ancestor, a person must have been upstanding citizen in society, follow all rules of social etiquette, fulfill their community obligations, and avoid all prohibitions and taboos. The benefits of membership always come with the risk of being deemed unworthy - these are, after all, tools by which societies distinguish exceptional persons from less exceptional ones. Along with clearly demarcated roles in society, cultural membership is full of middling levels - partial
personhood may be ascribed to those with disabilities (Landsman 1998), or to the unborn (Morgan 1997). We might imagine membership in engineering delineated along similar boundaries: must have done well in math in high school, must pass Differential Equations in college, must earn a degree from an accredited institution, must profess a love of technology. Kunda’s (2009) work on engineering culture follows similar lines, finding that cognitive and emotional distancing are important social practices for engineers, including depersonalization and the maintenance of clear separations between work and home spheres. Kunda finds various levels of membership in engineering, differentiating between “successful selves” and “failing selves”, along with ranks of membership lower in the corporate social hierarchy, such as administrative assistants and contingent employees.

Women are often directed along different tracks of membership - social roles are frequently divided between men and women and gender-related boundaries and taboos exist that prevent women from adopting men’s roles, and men from women’s. Generations of women in societies around the world have pushed for women’s equal status with men along various points of contention, including the right to vote, the right to an equal education, the ability to control their own finances. In the United States, the ability for women to work and find success in male-dominated fields is one of the most prominent frontiers in women’s rights. The literature studying the gendered and racialized boundaries of membership in engineering contains a dizzying spectrum of potential factors. The vast majority of studies interrogate “engineering

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2 Many human societies have developed gendered divisions of labor that distinguish “men’s work” from “women’s work”. There is wide cultural variation in types of activities typically performed by men or by women. Margaret Mead famously undermined notions of women’s “natural” preference for domestic activities by giving examples of societies in which women were warriors, or in which labor was divided equally (Mead 1935). Later feminist scholars (Ortner 1972; Rosaldo and Lamphere 1974) have further demonstrated that the contemporary arrangements of domestic v. public divisions of labor have their roots in Western patriarchal societies, and are not due to any inherent biological or “natural” inclinations toward motherhood, care-giving or any other attribute commonly assigned to women.
identities” and the ways in which these align or misalign with gender identities (Liebrand and Udas 2017; Sinnes and Loken 2014; Faulkner 2009a; Faulkner 2009b; Kvande 1999; Tonso 1998; McIlwee and Robinson 1992), many of which detangle the relationship between gender and technology (Holth 2014; Mills et al. 2013; Holth and Mellström 2011; Wajcman 2010; Faulkner 2009b; Bastalich et al. 2007; Bray 2007). Others focus on unequal social networks (McDonald 2011; Shih 2006; Kalev, Dobbin, and Kelly 2006; Ibarra 1997) and potential for hiring and promotion biases (Williams, Kilanski, and Muller 2014; Sharp et al. 2012; DiTomaso et al. 2007; Tang 2000; Smith, DiTomaso, and Farris 2001; Miller 2002; Dainty, Bagilhole, and Neale 2000; McIlwee and Robinson 1992). Others have pointed to interpersonal interactions and women’s exclusionary experiences on engineering teams (Seron et al. 2016; Mills et al. 2013; Tonso 1998) and at conferences (González Ramos 2017). Others focus on socialization in early childhood (Margolis and Fisher 2003; McIlwee and Robinson 1992) or professional socialization throughout internships and early careers (Liebrand and Udas 2017; Seron et al. 2016; Holth and Mellström 2011). A few attempt to assess the influence of diversity programs (Seron et al. 2018; Williams, Kilanski, and Muller 2014; Sharp et al. 2012; Kalev, Dobbin, and Kelly 2006) and mentorship (Williams, Kilanski, and Muller 2014; Sinnes and Loken 2014; DiTomaso et al. 2007). Still others focus on the interference between work and family life (Mills et al. 2013; Sharp et al. 2012; Holth and Mellström 2011; Post et al. 2009; Kvande 1999). All of these lenses are immensely valuable in naming and validating the inequalities women face in the workplace and this work must continue. However, there is a tendency in engineering industry to latch on to one or two “fixable” problems - social networks or mentorship - and neglect the fact that it is a combination of all of the above that contribute to cultures of non-belonging. In the same way that enumerating the formal rules of membership does not encompass the full complexities of social
behavior, an enumeration of inclusion factors has always seemed to me insufficient to describe the feelings of loneliness and frustration of a career in which one feels fundamentally different from one’s coworkers. As such, I have pursued anthropological concepts of belonging as a more holistic understanding of inclusion which encompasses many of the above structural and relational factors, in addition to a sense of emotional support, the absence of which, I contend, is critical for understanding women’s struggle for acceptance in engineering.

In addition to the previously discussed formal rules of membership, Gammeltoft (2014) has argued that belonging is a relational experience, only partially about acquiring structural access to a group, but rather a condition of belonging to others, and of them belonging to you. This relationship comes with a set of responsibilities and obligations, necessitating sacrifices of oneself in the service of those to whom one belongs, and receiving reciprocal sacrifices in return. The feeling of non-belonging described by women engineers, I assert, is less a structural condition than a relational one: a need to forge relationships with their coworkers, as equals; to care for others and to feel cared for in return. Such conditions have become exceedingly rare in workplace settings. Perhaps many in the corporate world would consider it laughable or naive to desire belonging in this sense at work. Work has become a place where emotions are left at the entry, where relationships are professional, perfunctory, impersonal. Engineers, in particular, become queasy at the mere hint of emotional vulnerability. However, it is my contention that this affective belonging is particularly important for women and minorities in engineering, from whom great sacrifices are extracted and who experience tremendous obstacles in their careers. What is missing is often a sense of reciprocal care: a sense of camaraderie with their coworkers to help get through difficult experiences. The feeling that others will have your back if you screw up. The feeling of safety, allowing you to let your guard down. The feeling that so long as you
fulfill your obligations to the community, you will in turn be protected. Although the obstacles to inclusion are well-known and experienced by most women in the field, it is not the obstacles so much as a lack of belonging that push women out of the field (Ayre, Mills, and Gill 2013).

Gammeltoft and other scholars who have studied Eastern societies have noted that, by contrast, Western societies overlook the importance of collective experiences like social belonging, in favor of individual self-determination. Nikolas Rose writes, “in advanced liberal societies, people are not merely free to choose, but 'obliged to be free’ to understand and enact their lives in terms of choice” (Rose 1999:87). According to Western individualist logic, women engineers should strive independently to overcome the obstacles of inclusion, find success in their careers, and through that success find fulfillment. The problem is framed as one of individual success; if one fails - either to succeed or to feel satisfied with their success - it is an individual failure. This individualist framework neglects to mention that so much of success and failure is dependent on the environment and the community.

In contrast, a relational mindset makes visible the social frameworks that enable or constrict the possibilities of individuals. It also avoids overly-determinative problems of structure and agency, showing how individual behavior that appears contrary to self-interest is not always due to discipline, control, or manipulation, but often a calculated consideration of *to whom one belongs* and the obligations that are owed to maintain the state of relationship (Gammeltoft 2014:19–20). Similarly, Mahmood (2005) argues that Western liberal biases toward individual freedoms prevent us from perceiving the agency of choosing to meet our collective obligations to our communities. Furthermore, attention to relationality enables the concept of a relational self, which is allowed to change its nature depending on context. While the Western concept of fixed selfhood would perceive an identity that changes as inauthentic or incongruous, Kondo (2009)
finds that in Japanese society, individuals are expected to change their behavior when interacting with different groups at different levels of hierarchy. Conceptions of relational selfhood enable the possibility of multiple, complex and ambiguous selves that do not need to be reconciled or combined into a single “authentic” self. Anzaldúa (1999), a Chicana-American poet, highlights the struggle for women of color, who live in the “borderlands” of every social space they encounter, to reconcile their multiple intersecting and often contradictory identities. For women and minorities in engineering who attempt to conform with culturally-mandated engineering identities while maintaining separate gender and racial/ethnic identities, the possibility of a mutable, relational selfhood is liberatory.

Although this relational concept of belonging has much to offer, it faces stiff resistance in the United States, a nation that prides itself on rugged individualism. The belief that we are each responsible for making our own happiness is nearly unshakeable. However, belonging theorists contend that the need for relationship with others is an essential human need, and that this, as opposed to career success, is what brings true fulfillment in our lives. Over generations of liberal and neoliberal policies, our need for community is not so much diminished as forgotten. Belonging has become a thing we still desperately need, yet we have forgotten its name and cannot point to its existence. In the following sections, I show how cultivating ever-stronger individualist mindsets and forms of discipline within capitalist systems of labor undermine belonging in the workplace, exacerbating problems of equity and inclusion.

**Belonging at Work and the Cultivation of Self-Interest**

In work societies, disciplinary membership has become one of the most central modes of belonging. Our work identities define much of the way we interact in the world. This is particularly true in the United States, due to its uncompromising commitment to individual
career and financial success. While individuals have some degree of choice regarding their
discipline, “good citizenship” is equated with economic independence (Ong 1999). Those
without gainful employment occupy places on the margins of society. Dependents of the state,
including the unemployed, impoverished, and disabled, are maligned as social pariahs. Perhaps a
more resonant example for engineers, young adults who can’t find jobs immediately are chided
for their prolonged dependence on their families, becoming the target of jokes about living in
their parents’ basements. Chamberlain (2018) contends that this assumption of paid employment
must be considered a loss of freedom, arguing, “…almost no one is immune from the intense
material and social pressures to place gainful employment in some shape or form at the center of
life. As a result, we must squeeze our values, our needs, and desires either into, or as is more
often the case, around paid work” (Chamberlain 2018:11). Furthermore, citizens are
increasingly implored to “love their jobs” and seek personal fulfillment through their careers
(Weeks 2017; Kunda 2009; Gregg 2009). Weeks (2017) has argued that the desire to merge work
with passion is particularly resonant in the professional and managerial classes. Indeed, we might
also perceive the common engineering shibboleth to profess a passion for technology through
this lens. The selection of the engineering profession is one of many pathways that individuals
may choose to fulfill their expected role as citizens in society, and the profession comes with its
own set of membership requirements that enable continued success. The stakes are high, as there
are few logical pathways out of engineering, so individuals must continue to earn their status as
good citizens by staying in good standing and advancing through the typical rites of passage of
the profession.

Flexibilization is increasingly a condition of employment for workers (Harvey 2006; Ong
1999; Martin 1994). Following neoliberal logics of removing barriers to flows of capital and
goods, flexibilization has been used as a tool for multinational companies to move production processes overseas, mobilize workers globally, and selectively contract and expand in response to financial markets (Harvey 2006). Over the decades, workers have been entreated to become flexible themselves, more resilient in the face of layoffs, more marketable to future employers, more adaptive to the demands of work (Martin 1994). It is a condition that workers themselves have little knowledge of upon selection of a career, nor much input regarding how much or how little flexibilization they desire, and yet becomes an important part of their working lives.

Flexible policies are often embraced as a form of liberation, arguing that these arrangements grant employees more freedom to choose their own career paths and dictate their own schedules. However, the adoption of flexible lifestyles requires the acceptance of a great deal of career risk, as employees learn to accept job hopping, layoffs, and continuous learning as a natural part of working life in order to remain employable and employed (Martin 1994). Although such demands were previously concentrated among the working class, flexibility is now common amongst the professional and managerial classes (Berlant 2011). Professional employees are now expected to function as self-entrepreneurs (Chamberlain 2018:63), attending to their own career development and advancement. Nikolas Rose has decried flexibility as producing a “life of incessant job seeking” (Chamberlain 2018:62): obtaining additional training and certifications, maintaining social networks internally and externally, and making sure they know how to “market themselves” in volatile job markets.

Chamberlain has drawn a connection between flexibilization and the disappearance of community in work societies. Drawing upon Marx’s (1887) critique of alienated labor, Chamberlain argues that the individualism cultivated by flexibilization practices has not only alienated individuals from the fruits of their labor, but from the connections forged through
community. Such work resonates with scholarship that critiques neoliberal flexibilization as a system that “optimize[s] conditions for capital accumulation no matter what the consequences for employment or social wellbeing” (Harvey 2006:25). In contrast to the liberal models of the early 20th century that promoted the proliferation of free markets alongside “good governance” that maintained critical infrastructure, reduced poverty and provided education, the neoliberal state has advocated the elimination of all government interference. The deprivation of resources to social safety nets has been the equivalent of pulling up the ladders of social mobility, concentrating power amongst the already-powerful, consequently reducing the pathways for women and racial minorities to seek equal footing. Chamberlain argues that neoliberal flexibilization operates according to two related logics: (1) decollectivization, which aims to reduce the power of collective bargaining, and (2) individualization, which crafts policies that provide benefits to workers as individuals, and empowers workers through flexible working arrangements (Chamberlain 2018:48). The logics of self-determination have made individual flexibility seem desirable, producing popular productivity and self-help rhetoric that promises fulfillment through intensive self-improvement and career success (Gregg 2018). As Gregg has argued, such self-interested focus sits in uncomfortable tension with collective needs. In the prioritization of one’s own time and interests, the needs of others are subjugated, de-prioritized. In this context, women in engineering feel torn between their desires to act as a collective, promoting the advancement of all women, and the need to prioritize their own careers. High-ranking women in this study have reported instances in which these conflicts have unsettled them, noting how they have unintentionally hurt other women’s careers in the advancement of their own. Although their intent may be focused on the benefit of all women, the practices of flexibility cultivate mindsets focused on individual success. In this sense, workers’ everyday
strivings to remain respected members of their work communities enables the forgetfulness that
they belong to communities at all.

**Women and the Work of Balance-Keeping**

The cultivation of a single-minded individual focus does not diminish our need for collective
experiences of belonging. Alongside productivity and self-help rhetoric, it is easy to find
alternative narratives that remind American workers that there is more to life than financial
success and that their working lives are not their only source of fulfillment. This counterculture
intones a need for balance, rest, creativity, play, and healthy relationships. Engineers themselves
often invoke these refrains and cultivate meaningful lives outside of work through their families,
friendships, hobbies, sports and vacations. While these activities typically fall into the category
of “leisure”, make no mistake that the maintenance of these activities is work, albeit unpaid, and
it is time deliberately spent not engaging in paid labor. If the family is taking a ski trip, someone
will need to plan it, make reservations, make sure everyone has their ski gear, make sure
everything gets packed, make sure everyone gets on the plane. If the ski trip is a combined trip
with another family, an uncle or aunt or cousin, someone will need to communicate between the
families, make sure their needs are being met and make sure everyone from both families is
getting along. Although the vacation itself is an experience of leisurely family bonding, it
requires considerable effort and does critical work in the production of a meaningful and
purposeful life.

Women, I argue, have become responsible for the labor of “balance-keeping”, maintaining a
sense of equilibrium for their families in a world that is dominated by flexibilization, self-
discipline, and periodic upheaval. This “balance” work is similar to that described in feminist
studies of work and migration, who have noted women’s role in the maintenance of cultural
traditions and family ties. In regions where globalization has incentivized the transition from subsistence farming to factory work, such as Bangladesh (Lynch 2007) and Malaysia (Ong 1987), while men have been enlisted as the primary laborers in emerging markets, women have been made key symbolic bearers of cultural values, family networks and spiritual traditions. Global migration has necessitated the reimagining of family structures to accommodate distance between spouses, parents, children and extended families. In her study of migrant women in domestic labor, Hondagneu-Sotelo (2006) finds that Latina women have redefined motherhood in a way that enables them to demonstrate their care for their children from a distance. Romero (2006) similarly observes that women who bring their children with them to the U.S. often have to sacrifice care for their own children with the paid care that they provide as nannies and housekeepers. In these arrangements, women become the glue that holds the family together across cities, nations and continents.

Even families that do not migrate feel the strain of contemporary capitalist labor. Although two incomes are often required for contemporary middle class families, there has been no subsequent provision to account for the invisible labor that is required to raise children, maintain a household and maintain family networks. An abundance of literature on women’s work has repeatedly highlighted the challenges of the “second shift” of unpaid, undervalued labor that women are responsible for in the home after a full day’s work (Collins 2019; Bailyn 2006; Hochschild 1997; Hochschild and Machung 1989). DiLeonardo (1987) wrote over three decades ago that in the difficulty of squeezing the demands of work and their immediate families, “kin work”, or the maintenance of extended family networks through holiday cards and family gatherings, was simply falling through the cracks. Women did not have the time and men did not have the motivation. “Balance work”, I argue, builds upon these observations of “tradition-
keeping”, the domestic labor of the “second shift”, and the extended family work of “kin work” to extend to the labor of maintaining stability in an increasingly unstable world. It is perhaps unsurprising that in contexts in which our local communities have been weakened through the absence of this invisible labor, there is growing concern over increasing loneliness, depression and anxiety in the United States (Reinert, Nguyen, and Fritze 2020; Klinenberg 2018; Slater 1990).

It is important to perceive women’s obligations in the home as ones that are rooted in the relational sense of belonging to that Gammeltoft describes. Women, in their recognition of “balance work” as a critical source of care that sustains their families, are motivated by a sense of obligation, responsibility and love. At the same time, it should be made clear that these efforts are indeed a form of labor. Although entreaties to consider domestic work through the lens of a “labor of love” has been used to justify and enshrine these tasks as “women’s work”, there is no reason why men cannot or should not be capable of sharing these obligations. Through this “balance work”, families on the “integrated circuit” create the communities that sustain and satisfy their needs for belonging. In their recognition of the importance of this task, women in professional careers often intentionally embrace the disciplinary techniques of flexibility as the only way their lives can retain a semblance of “balance” (Gregg 2008). Indeed, Chamberlain argues that flexibilization is the only option that has been offered in the workplace as “a privatized response to the contemporary deficit of care…Flexibility offers a partial and individualistic solution to the problem of how to meet our responsibilities for care with the necessity of paid work” (Chamberlain 2018:67–68). Flexibility does not reduce women’s workloads, but simply redistributes it, so that it is performable at any time of day. As a result, flexibilization has become a feminine marker in the workplace, a policy that is perceived as
necessary for women, but not for men (Gregg 2008). This presumption has contributed to the ongoing “boundary heightening” in professional and managerial labor; although flexibility simultaneously creates opportunities for women’s participation, it undermines that participation through perceptions that women are working fewer hours, have more freedom, and/or are not as committed to their careers.

This has been the primary sacrifice that is extracted in women’s belonging to both their families and their careers. Women feel torn between the necessity of flexibility and the state of anxiety it produces in their everyday lives. The irony is that the only solution seems to be more flexibilization, more self-discipline. “In light of previous (failed) visions of labor solidarity, the worker is asked to recognize and accept his or her mobility as the only form of freedom now possible or desirable” (Gregg 2008: 290). In order to extract more freedom from their rigid schedules, engineering professionals must redouble their disciplinary efforts to find scraps of unused time to be put toward sources that generate more meaning in their lives. Berlant (2011) has written of “cruel optimism”, referring to sacrifices that are made toward ideals which will never deliver on their promises, and often further undermine their achievement. This, I argue, is the situation women engineers find themselves in: they have been promised that this flexibilization is necessary for their success at work and will result in not only their own personal fulfillment, but will pave the way for future generations of women. However, the promised “balance” never arrives and the practices of individualization actually undermine the sense of women’s collective solidarity that is required to bring about equitable workplaces.

**Engineering: An Extreme Case**

One might argue that such broad patterns are observable in all disciplines, and that their presence in engineering does not account for the noticeable dearth of women and racial
minorities in the profession. On the contrary, I suggest that engineering is a discipline that has proven to be particularly persuadable by the logics of flexibility and hostile to the cultivation of emotional connections that belonging demands. Noble (1977) argues that the work of engineers has been crucial in the American development of standardization and flexibilization practices within corporate capitalism. Not only do engineers produce the technology that is required for such efforts (i.e. computers, robotics, etc.), but engineering professional organizations, in their bid to establish engineering as a legitimate field of practice, were the masterminds of scientific management practices in order to attract corporate employment and investments (Noble 1977).

Through Noble’s work, we begin to see engineering companies not as hyper-masculine, hyper-technical, anti-social anomalies in the corporate world, but rather as the ideal form of corporate standardization. Indeed, it was electrical and chemical companies such as General Electric, DuPont and Dow that pioneered scientific management practices in the 1920s that the rest of Corporate America later adopted. Although this history is largely forgotten amongst rank-and-file engineers, it is firmly rooted in the culture of the discipline. Engineering companies are the most systematic, the most rigid in structure, process and routine, the most steadfastly committed to meritocracy, efficiency, and depersonalization.

Although corporate and engineering interests largely align, Zussman (1985) has argued that there exist fundamental conflicts between engineering and management goals. While corporate management uses optimization as a tool to maximize profits, engineers prefer to optimize processes. Efficiency, therefore, is the ultimate goal of the engineer. Productivity improvements are a regular feature of engineers’ work in the company, and their familiarity and expertise with these systems has led them to enthusiastically extend the principles of productivity into their personal lives as an unquestioned benefit. In the process of optimizing their lives, however, they
eliminate a great deal of human social interaction that they consider to be wasteful. Gregg (2018) has characterized productivity rhetoric as a system that enables individuals to pursue their self interests freely, a tool that justifies their liberation from the needs of, or obligations to, others. Using the example of a typical task list, Gregg argues that through the process of prioritizing tasks according to “important”, “unimportant”, “urgent”, and “non urgent”, individuals are encouraged to eliminate things that are not immediately important, or to delegate them to other (less important) people. Amongst the items most frequently on the chopping block include social interactions with others and care work, which are not seen as providing value.

I contend that this is a critical component of the engineering discipline’s struggle with inclusivity. Workplace inclusivity requires extra care to correct the fundamental inequalities that undermine reciprocity as equals. It requires a willingness to step out of one’s prescribed role and comfort zone to learn more about the lives of others, to inquire about personal matters, to demonstrate an interest in friendship beyond the context of work. While such concerns are not a problem for those in the majority - in this case, white men - whose belonging in the profession is more easily recognized and affirmed, those in minority groups are never truly insiders, and additional carework is required to generate an inclusive experience. The problem here is not that engineers do not care about being inclusive or are somehow more hostile toward women and minorities than other professions - many do express a desire to retain women and a frustration with why that seems to be so difficult. I suggest that a crucial piece of the problem is that the work of inclusivity is the kind of labor that engineers deem wasteful and unnecessary. Inclusive practices are eliminated from their task list in the name of optimal efficiency.

Furthermore, engineers have a perplexing stubbornness toward work-from-home practices that tends to disadvantage women, due to cultural preferences that work and family remain
separate spheres and gendered assumptions that women will always choose to put their families first. Given their propensity for flexibilization in other forms, it might be expected that engineers would embrace workplace flexibility practices. However, in the minds of many engineering managers, flexibilization to accommodate family life is disruptive of workplace efficiency. In engineering, there is no such thing as part-time work; engineers must be full-time employees. If an employee has care obligations that make them unavailable to the company for the entire standard workday, there are very few alternatives beyond simply choosing to do something besides engineering. Although women engineers are increasingly trying to negotiate work-from-home arrangements,\(^3\) these are determined on a case-by-case basis and approval is dependent on the manager’s opinion of its efficiency. Women have difficulty persuading their managers that they are as productive at home as they are at work. The invisibility of their labor at home creates a dynamic in which women feel they must be hyper-productive, doing more work, maintaining more self-discipline, than would have been expected in the office, in order to offset beliefs that they are not working as hard (Gregg 2008). Furthermore, these work-from-home arrangements are not available to all engineers equally and tend to be limited to those who have office jobs. For women who work in manufacturing, the process must take priority - it would not be acceptable for women to be absent if there were urgent issues on the shop floor. The combination of intensive individual productivity coupled with resistance to the types of flexibility that provide a measure of relief for women have made engineering a very difficult environment for them to thrive in.

The field of semiconductor engineering is a case study in a profession that is undergoing increasing flexibilization. The industry is a global enterprise that employs flexible

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\(^3\) This research took place prior to the COVID-19 pandemic of 2020-21, during which women struggled to obtain permission to work from home. After the pandemic, these conditions have most likely changed.
manufacturing, a mobile labor force, and responsiveness to the ebbs and flows of capital, resulting in periodic scaling up and scaling down, and subsequent hiring and firing of personnel. The unstable nature of the labor market, the possibility of employees undergoing major relocations every few years, has generated a culture that severs many of the traditional modes of belonging for employees. The sense of belonging to, of reciprocal obligations, that has been a fundamental quality of human membership, is no longer perceived to exist between employers and employees, or between members of the engineering community. It is a community driven by individual striving to remain competitive in a world that is rapidly changing. It is a culture in which much sacrifice is extracted for continued membership, but little stability is offered in return.

Some may mistakenly reduce my argument to presume that women’s conflict in engineering is due to the difficulties of caring for their families - I want to be very clear that statistical data shows that a considerable minority - only 30% - of women who leave the profession attribute their departure to family conflicts (Singh et al. 2013). Rather, what I argue here is that women struggle in engineering because the culture, driven by flexibility, individualism, and efficiency, devalues the practices of collective belonging that might justify the sacrifices the profession extracts. The experience of belonging is essential for all employees, not merely those with families; even engineers without children must similarly perform care work to generate these experiences. The women in this study have chosen to stay in their careers. While many wish their journey had been easier, they love their work and find joy in their lives. On top of their own personal success, they further strive to bring about a new generation in which women are no longer a minority in the profession. And yet their stories demonstrate how difficult the balance between work and family is to maintain, how precarious their lives are on the integrated circuit,
how difficult it has been to juggle self-interest in their own careers with collective action on behalf of other women.

Engineers in this sector often embrace their globe-trotting lifestyles, enjoying the experience that comes from working abroad and in multicultural environments. They creatively generate new kinds of meaning in their lives through friendships, hobbies, travel experiences, and within ethnic and religious communities. And yet, much of this work rests upon women who perform invisible work of “balance-keeping” while maintaining and advancing in their careers. Women painstakingly spin new strands of meaning into a social fabric that has become threadybare, constructing webs of belonging, the absence of which is felt but unnamed, essential yet forgotten.

**Chapter Overview**

This work is not the straightforward study of diversity in the workplace that I originally intended. The layoff significantly shifted my understanding of what it means to belong in this industry as I watched highly-educated, highly-competitive engineers scramble to find a stable foundation. Although it is not the ethnography I expected to write, my hope is that it will prove interesting and thought-provoking to my readers. It spans multiple disciplines, bringing together discussions that reside within the fields of gender, migration, work and engineering studies. To anthropology, I bring an analysis of how transnational capitalism produces flexible citizens, who perform complex negotiations of gender, race and ethnicity in a multicultural high-tech workplace. To engineering studies, I offer a perspective on gender and race in engineering that transcends national boundaries and shows how global political and labor structures shape the experiences of engineering workers. I show that the structures of engineering work, family, and nation mobilize and direct men and women of different nationalities along different pathways in
engineering, and the strategies women and migrant engineers employ to find fulfillment in their careers. I find that these engineering outsiders endure intense flexibilization and face gendered and racialized codes of conduct in this male-dominated career. Drawing upon feminist critiques of flexibility and Gammeltoft’s conception of belonging as an essential human need built on systems of reciprocal obligation, I illuminate the neoliberal erosion of stability for women and migrants in professional careers. I conclude that here at the “bleeding edge” of technological production, women and migrant workers have few options beyond increasing feats of flexible self-discipline.

Chapter 1, “Of Channels and Pipelines”, shows how engineers from various locations around the world are mobilized into the integrated circuit. While research on women in STEM typically assumes the primacy of individual choice of engineering careers, anthropological theories of transnational labor and migration reveal that engineers are instead made through government and market incentives, strong educational infrastructures, and cultural preferences. I highlight that uneven global development facilitates a large volume of semiconductor engineers from countries such as India, and China, while engineers from countries “off the beaten path” face greater obstacles. While these structural forces generate high numbers of male engineers, women are not typically seen as a part of this transnational engineering project. Women in semiconductor engineering may, in theory, have access to the same resources, but they are constrained by patrifocal structures, which vary by nation, race, ethnicity, and religion. Critical factors include: access to girls’ education, timing of marriages and children, cultural perceptions of women’s safety, careers that are suitable for women, and masculine and feminine traits, skills, behaviors and dispositions. I show that women who eventually land in semiconductor engineering exhibit strong personal agency to overcome these barriers.
Having been mobilized into the integrated circuit, semiconductor workers navigate the transnational labor market, often moving between cities, countries and continents, guided by market forces and immigration policies. Chapter 2, “Geographic Flexibility on the Integrated Circuit” shows how nation-states and labor practices direct movement of employees around the world and demonstrates how decisions to migrate are mediated by family structures. The global integrated circuit is a constant stream of judgment calls on how to balance the needs of families with the needs of labor. Frequent conflicts include the “two body problem”, in which both partners work in a highly mobile labor force, moving with children, and whether to take a career gap while the other partner pursues a promising opportunity. Such decisions often require the reimagining of families themselves, to accommodate a more flexible, mobile interpretation of family structures, and a reimagining of fatherhood, motherhood and the needs of children.

Chapter 3, “Flexible Mindsets” builds upon feminist interpretations of flexibilization to show how family and labor are managed in everyday life amongst women in semiconductor engineering. Pursuing the ideal state of “having it all”, women in this male-dominated field adopt flexible mindsets that enable them to achieve a semblance of “balance”. Drawing upon Sloterdijk’s (2014) “athleticism” and Gregg’s (2018) critiques of productivity, I show how the individual focus embedded within these disciplinary techniques often undercuts a sense of collective solidarity that might deliver more consistent, equitable improvements in women’s work in engineering. However, for women in this field, these everyday flexible mindsets are viewed as absolute necessities, carrying promises of their own personal freedom as well as the ability to forge a pathway for other women in their wake. In this sense, I interpret this effort as a form of “cruel optimism”, an effort whose outcome is an imagined future, rather than a reality,
whose arrival is never guaranteed, and in which the action of pursuing simultaneously undermines the foundations of equity that were the ultimate goal.

Having reviewed the political and economic forces at work which mobilize particular actors in the semiconductor industry, I shift my attention to the way belonging is produced in the multicultural world of semiconductor engineering. Chapter 4 “Negotiating Engineering Identity in The Multicultural Workplace” describes the excitement and fulfillment that many feel being a part of this transnational community along with the difficulties that arise due to conflicting cultural understandings in the workplace. I begin by outlining the shifting American concept of an ideal engineer from the stereotypical “geeky, antisocial” identity to a more recent corporate push for engineers with better communication, teamwork and leadership skills. While the American prioritization of communication and strategic thinking has been an opportunity for women to emphasize their own value with “soft skills”, these same skills are challenging for engineers who were educated in Europe and Asia, who tend to value technical proficiency over performance. Upon relocation to the U.S., immigrant engineers must re-negotiate their reputations, which have been founded upon being technically excellent, in favor of being better able to communicate their ideas and align themselves with the company strategy. Intersections of gender and ethnic identity are also important factors in these negotiations. Stereotypes of East Asian women as docile and compliant undermine their efforts to advocate for themselves, whereas White and South Asian women are able to manage with less difficulty. Thus, the multicultural workplace requires a certain cultural malleability for women and migrant engineers in order to fit into the expected role of engineers in the US.

For those who wish to move up in the workplace hierarchy, further discipline is required. In Chapter 4, “In/Visibility: The Politics of Getting a Promotion”, I describe the strategies
engineers use to climb the corporate ladder. Eligibility for promotion requires taking on additional work “above and beyond” the normal duties of one’s job. It also requires additional feats of self-discipline, embracing values such as productivity, meritocracy, and individualism, which are core mindsets in American engineering companies. Furthermore, this additional work must be “visible” at upper levels of the workplace hierarchy, which is dependent upon the strategic value of the work and the ability of both the employee and their manager to showcase it. I show that the pathways for women’s promotion operate according to different rules and timelines than those for men. Women have greater difficulty with visibility since they often get stuck with routine, invisible maintenance work. Simultaneously, their self-advocacy efforts are hyper-visible, frequently labeled “aggressive” if they promote themselves too forcefully or “emotional” if they complain about the work they have been assigned. Women’s promotions often diverge from the expected linear timeline, punctured by multiple lateral moves and deliberate “stepping back” to care for their families. I also highlight the emergence of women’s vertical networks as acts of solidarity that, if conceptualized and prioritized as such, have the potential to increase women’s collective power and normalize their alternative career paths.

Life in the integrated circuit, requires extraordinary flexibility - of geographic region, cultural practices and individual mindsets - in order to produce oneself as a successful engineer. In Chapter 5 “Flexible Selves”, I return to my original theme of belonging to show how this intense flexibility undermines individuals’ need for stability and to belong to a community. Indeed, for most participants in this study, belonging is never fully achieved, but is instead a fleeting experience, found in particular contexts. However, semiconductor engineers resist the flexibilization of their lives in small ways, finding communities outside of work, such as family, religious and ethnic groups, and sports, that fulfill their need for belonging. Flexible selfhood is a
strategy that enables engineers to find compatibility with strangers and community in unfamiliar environments.

In the conclusion, I return to the impact of the layoff in this community. Engineers in the integrated circuit have exchanged common pathways of belonging, through kinship and regional community, for exciting careers on the leading edge. They earn high salaries, enjoy prestigious, fast-paced careers, and have gained cultural knowledge in their travels. While some express resentment about their circumstances, most feel satisfied with their careers. However, Gammeltoft (2014) reminds that the achievement of belonging in any community is fragile and contingent; while stable, it is rarely permanent and subject to changing circumstances. This was made clear in the aftermath of the layoff, which shook the stability of many engineers in this region. Engineers who had thought themselves secure now scrambled to find new positions, refresh their external networks, and navigate complex visa deadlines. Many experienced this event as a betrayal; at the very least, it was a recognition that companies do not feel responsible for – or perhaps misunderstand their role in - creating and sustaining community. Even engineers who were not laid off brushed up their resumes and set off to chase the bleeding edge in other locations. The resulting turmoil revealed the important work that women do in creating community in these global networks, which I have endeavored to make visible. I close with a consideration of the risks and implications for communities of belonging that are based on capitalist circuits of labor. I present some alternative possibilities for rethinking work to make life more manageable for women and to more sustainably reflect the human need for community. While these engineers find themselves on the “bleeding edge” of both technology and flexibilization, we can choose to value community differently and work toward a more sustainable future.
CHAPTER I

“They Will Set the Path For You”: Of Channels and Pipelines

“They won’t allow you. They will put thousands of limits. Hey, girls, you cannot go there, you cannot do this, you cannot touch that... There’s a limit. They set the limit and that’s it... They will push me to the lab section. The R&D section. Not on the production floor. It’s always, they will - (pause) - you won’t be able to do what you prefer to do. They will set the path for you. They will choose it for you. Where you can go, where you cannot go.”

Naomi (F, 37, Bangladesh) is a graduate student at the local nanoscale engineering university. She describes her frustration by her lack of control over her own career in the garment manufacturing career she abandoned in Bangladesh. She calls it “channeling”, a sense that her career has had guardrails preventing her from going off the track others have proscribed for her.

Naomi grew up in an educated family in a medium-sized city in the district of Khulna. Her father was a banker. Her mother earned a side income selling crafts in the market. Naomi’s father and uncles didn’t approve of her mother working, but she never asked them for permission. It was good for the financial security of the family, she argued. To her daughters, she emphasized the importance of having their own income: “You have to be self-sufficient,” she would tell them, sternly. “Don’t end up in the kitchen.” Naomi took this advice to heart and threw herself into her education. Girls’ education was uneven at best in her hometown and most of the girls “got lost”, dropping out to start families before earning their high school diploma. But Naomi was an outstanding student and earned a full scholarship to a college in Dhaka, the capital city. Her mother expected her to study medicine, but she insisted on engineering, the exciting new career that many students of her generation were going into. Two of her cousins had become engineers and her uncle had a friend at MIT who thrilled her with stories of the technologies being developed in the U.S. “Their research is going to lead the world,” she remembered thinking.
For Naomi, being a girl in engineering was full of disappointments back then. She was one of only four girls in her college classes and they quickly banded together for support. She selected chemical engineering and managed to match herself with a female advisor. However, when it came time to pursue an internship, she found that the girls’ experiences were markedly different from the boys’. The girls were not allowed on the shop floor, supposedly for safety reasons. While the boys got “hands on” experience climbing on ladders, inspecting columns, and troubleshooting manufacturing processes, she and her female colleagues were instructed in classrooms using flow diagrams.

“During the daytime we were supposed to go to the factory and work as a process engineer. We are supposed to shadow [a process engineer] for the entire day. But that never happened. Not for a single day. That was frustrating actually because the flow diagrams, we were seeing those during my coursework in my engineering school…I already know that! I want to see how do you do it actually! But they won’t [let you]. In that 21 days, I can count maybe 2 or 3 days max they took us inside the factory. The rest of the time we were stuck in our room with instructors who would come and talk about how does this process work.”

When Naomi graduated, she found a job in a garment factory, a major growth industry in Bangladesh. Naomi was interested in production processes and wanted to pursue a career in manufacturing. However, she quickly realized this would be almost impossible for a woman. Production was considered unsafe for women - not only did it require working with heavy machinery, but it required being on-call at night. Women were not allowed to be out after dark. Instead, women were shuffled into Environmental Health and Safety (EHS) roles in the company, which were mostly desk jobs. Naomi became even more frustrated when the company began trying to transfer her to factories in remote rural areas. “I would not be able to survive there,” she said matter-of-factly, referring to the further restrictions on women’s freedom outside the cities. After only six months in the garment industry, she quit. “This is not going to work, I’m
just wasting my time here,” she realized. She got a government job instead in an EHS role, conducting inspections of factories in various industries - food production, healthcare, dying, etc. It wasn’t her ideal job, but she enjoyed the work and was comfortable there. They allowed her to work from home when her first son was born - an unusual arrangement for women in Bangladesh at the time. “Whatever you need to be comfortable,” her bosses said, “just please don’t quit!”

Things went well for a few years until her husband, also an engineer, developed health problems that mandated he leave his manufacturing job. The couple decided to pursue graduate degrees in the U.S. Although it was his health issues that pushed them into research, she was the first to get into a PhD program in New York. Remembering her previous fascination with MIT’s cutting edge technology, she chose a degree program in semiconductors. She has struggled to balance caring for her two sons with graduate school, but the excitement she feels for her new career in semiconductor engineering far outweighs the stress and effort it took to get here. “All these paths are changing lives. These chips we design in manufacturing, every single thing, I really love that. I’m so happy to be a part of that.”

Naomi felt that her early career had been channeled by forces beyond her control. It took her tremendous effort to break out of the prescribed pathway that was expected for women in her hometown in Bangladesh. Her story is similar to many immigrant women, who struggle against cultural narratives about women’s role in the household which compete with their desires to have careers of their own.

The semiconductor industry encompasses workers from around the world, and yet studies of women in engineering tend to center Western countries like the United States, Europe and Australia. In order to gain a holistic picture of the semiconductor industry, both locally and globally, I have found it necessary to learn more about the lives of migrant workers and their
pathways into the industry. Although American women experience many of the same structural pushes, pulls, and restrictions, immigrant women’s stories, particularly those from South Asia, include additional obstacles, such as access to education and strong cultural preferences that women stay at home to care for their families. These understandings are important for understanding the semiconductor global labor circuit as a whole, and the ways in which Western- and male-dominance are reproduced in this high tech field.

This opening chapter focuses on the structural factors that drew women into semiconductor engineering and situates the field of semiconductor engineering as a global enterprise that unequally recruits migrant workers from around the world. Drawing upon the work of feminist scholars working at the nexus of transnational and intersectional studies, I argue that semiconductor engineering - like all engineering disciplines - must be conceptualized as a key component of a global neoliberal market system that perpetuates global and gender inequalities. I employ Mahler and Pessar's (2006) "gendered geographies of power" (GGP) to theorize the unevenness of accessibility to the engineering labor force depending upon one's gender and country of origin. Mahler and Pessar have argued for greater attention to gender in migration studies, on the basis that gender roles underlie the logics of institutions (such as the labor force and families) that are critical in determining mobility. Mahler, Chaudhuri and Patil (2015) have recently further developed GGP in conjunction with intersectionality, arguing that most intersectionality studies presume a nationally-bounded subject - a position that is increasingly untenable in a globally-linked world. In their study of Bengali women and families in Florida, the authors demonstrate that immigrants occupy a liminal space in which they may be privileged in relation to their home circumstances while simultaneously disadvantaged transnationally, or vice versa.
Engineering studies, as well, have frequently presumed closed systems within national boundaries, failing to acknowledge the discipline's participation in neoliberal globalization. Indeed, engineering and technological advancement have played a critical role in the production of uneven global development. Under neoliberal economic models, nations are encouraged to "modernize", embracing technological development to gain political and economic advantage on the world stage. Since the World Bank World Development Report (WB 1998) which recommended that developing nations prioritize the development of knowledge economies, “knowledge” has become a popular mantra for nations seeking pathways out of debt and employment opportunities for their citizens (Radhakrishnan 2011:37). Engineers have been instrumental in the process of modernization, embracing the creation and implementation of standardization and productivity optimization tools (Noble 1977). Given this connection, nations seeking to modernize unsurprisingly prioritize the education and training of engineers. However, as Harvey (2006) argues, neoliberalization is characterized by the contradiction between the promise of increased competitiveness while in practice consolidating power and wealth within the global elite. The Western world retains control of dominant industries and elite education systems, while redistributing labor and resources from marginalized nations, a process Harvey calls "flexible accumulation" (1989:147). In semiconductor engineering, this process involves acquiring top talent from nations around the world, frequently utilizing Western education systems as intermediaries, and rerouting them within the industry to regions in which cutting edge technological development is taking place. It is perhaps ironic that engineers, at once the producers of technologies and standardizers of technical processes, now find their engineering labor is itself a commodity to be optimized, producing a global class of professional migrants to be rotated around the world. Like Mahler et al.’s (2015) Bengali families in South Florida,
participating in this global labor circuit is at once a privilege and a curse; these careers offer competitive salaries and benefits and an opportunity to improve their social mobility, while simultaneously mandating that employees uproot themselves from their social support networks, families and local communities and embed themselves in host countries in which they are perceived as minority “others”. Despite the drawbacks, semiconductor engineering provides elite opportunities that are not equally available to workers from all nations. A few countries, such as India and China, have negotiated privileged positions through high quality education systems, national strategic priorities of modernization and alliances with Western industries; meanwhile, other nations continue to struggle with stubbornly high poverty rates, uneven education systems, international debt, and occasionally, war and sustained conflict. Women's access may be further hampered by girls’ access to education and local expectations of family roles and gender performance.

By attending to these global structural constraints, I intend to address what I perceive as an over-emphasis on individual agency in literature on women in engineering. Massey (1994) has called for greater attention to - and critique of - agency in migration, observing that “[There are] groups who are really in a sense in charge of time-space compression, who can really use it and turn it to advantage, whose power and influence it very definitely increases…but there are also groups who are also doing a lot of physical moving, but who are not ‘in charge’ of the process in the same way at all” (Massey 1994:149). Such is the case for migrant engineers, who have a certain amount of agency upon choice of career, but once they have begun on the path are pulled in directions that are not entirely within their control. Massey et al. (1999) have argued that four basic elements should be present in migration studies: (1) the structural forces that promote emigration in the country of origin (i.e. “push” factors), (2) the structural forces that attract
immigrants in the destination country (i.e. “pull” factors), (3) the social and economic structures that connect origin and destination countries, and (4) the aspirations and motivations of those who respond to these forces by migrating (1999:281). Furthermore, there is a “mobility bias” in migration studies (Schewel 2020), in which the literature focuses on only a small percentage of the world’s population that is mobilized internationally (less than 3.5% in 2019) (MDP 2020) and in which the overwhelming majority of the population remains immobile, either voluntarily or involuntarily. Schewel (2020) adds to Massey’s theoretical framework two additional factors that should also be taken into account: (5) the structural forces that resist or constrain migration and (6) the aspirations and motivations of actors who respond to structural forces by staying in place (2020:329). Gender differences in international migration constraints and aspirations are notable due to the targeting of women for different types of migrant work (typically related to service-, care- and/or sex work) and due to family and cultural expectations. Employer-related labor flows remain understudied in migration literature, and fewer still investigate women's migration in male dominated fields such as engineering (Bagchi 2001).

Perceptions of desirable careers are shaped by national priorities. Engineering, in particular, is a discipline which is highly prioritized by nation-states as a tool for technological development and improved global standing. The two most common rationales for choosing a career in engineering are either (a) a fascination with technology, or (b) the understanding that engineering is a “practical” career with a high salary and job security (McIlwee and Robinson 1992; Faulkner 2009a; McLoughlin 2009). The state plays a major role in both of these imaginings, by valorizing technological progress in the former and by incentivizing the creation of well-paid jobs in the latter. Scholars have long critiqued the prioritization of flashy high-tech jobs over other types of labor that, while mundane, are no less crucial for a functioning state. In their
comprehensive argument for the overvaluation of high tech sector, Gordon and Kimball (1985) point out that the shortage of high-tech labor may not be as dire as it is portrayed, and it tends to deskill jobs as quickly as it creates them. In 2018, the majority of the top 20 fastest growing employment sectors were related to healthcare; only five of these were related to technology, including software engineers (US BLS 2019), and the two fastest growing sectors are solar and wind-turbine installation, which do not require a bachelor’s degree. Despite this, high-tech employment generates its prestige from the perception that it will advance global competitiveness,¹ justifying high levels of government investment. This perception generates considerable concern over labor shortages in disciplines such as engineering, driving numerous studies of career pipelines and pathways, trying to ascertain why engineers choose to pursue STEM careers, how to engage more young people in STEM fields, and how to prevent them from leaving the industry. For example, a recent intersectional study (Lord et al. 2019) thoroughly traces the pathways of key demographic groups in engineering colleges as they transition between different majors, trying to ascertain the “stickiness” of particular disciplines in relation to others. Cruz and Kellam (2018) have noted that many young people entering engineering careers are misinformed about what engineers actually do, leading to their disappointment upon discovering that the majority of engineering positions are not as cutting edge as they have been made out to be, a phenomenon known as the “bait and switch”.

The retention of women and minorities are of principle concern in engineering due to a combination of the above-mentioned labor shortages and the fact that engineering lags behind nearly every other scientific field in gender and racial diversity (only computer science performs

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¹ Gordon and Kimball (1985) also contest this claim, arguing that it is not technological innovation, per se, that improves competitiveness, but rather the degree to which those technological developments are integrated within existing global economic systems.
more poorly on these measures). In the United States, in which many of these studies take place, the government has courted female engineers for decades as a source of surplus labor to fill vacant positions in technical fields, through a combination of (1) affirmative action / equal opportunity policies, and (2) programs designed to encourage women to try their hand at STEM fields; these programs frequently collaborate with local industries and women’s organizations (Rossiter 2012). For public perception alone, it has become important for U.S. engineering colleges and industries to demonstrate that they are doing everything they can to improve diversity in their institutions, even while the statistics have remained relatively unchanged since the mid-1980s (NSF 2015). Retention of women and minorities in engineering has resulted in a number of groundbreaking studies pointing to the barriers specific to gender and race, such as hostile work cultures, structural barriers in education, racist and sexist stereotypes, and conflicts with domestic responsibilities (McIlwee and Robinson 1992; Tonso 1998; Faulkner 2009a; Faulkner 2009b; Slaton 2010; Camacho and Lord 2013). In choosing a career, women and minorities must first overcome stereotypes that associate math and science, along with associated qualities of spatial skills and intelligence, with whiteness and masculinity (Archer, Dewitt, and Osborne 2015; Cooper, Krieg, and Brownell 2018; Correll 2004; Ortner and Sieverding 2008). In contrast to men, who are most likely to describe choosing engineering due to a passion for technology, for women, the practicality of engineering was of paramount importance in their choice of career (McIlwee and Robinson 1992; McLoughlin 2009). Although most engineers, men and women, find it necessary to describe their affinity for technology in order to establish themselves as “real engineers” (Faulkner 2009a), McLoughlin (2009) argues that a significant portion of women are drawn to engineering due to high level of organizational and educational achievement, not necessarily due to technical skill or interest. As a result, the perception of
engineering as a practical, well-paid career was particularly important for setting these women on the pathway of an engineering career. Studies of women’s persistence in engineering (Ayre, Mills, and Gill 2013; Buse, Bilimoria, and Perelli 2013; Cech et al. 2011; Seron et al. 2016) tend to be centered around women’s individual agency, measuring qualities such as confidence, identification with engineering identity, ability to express themselves openly, and sense of engagement in their work. Many of these studies also acknowledge immediate cultural factors such as sexism in the workplace, gender stereotypes, institutional cultures and domestic conflicts. While immensely valuable in their critique of engineering institutions and gender stereotypes, these studies seldom consider where the demand for labor comes from, why women and minorities are desired, and how the pushes and pulls of labor create inclusions and exclusions.

Following Mohanty’s (Mohanty 2013; Mohanty 1984) call for transnational feminist scholarship that acknowledges the power structures that create persistent global inequalities, I argue that the global engineering labor market is of critical importance to a discussion of inclusion, persistence and inequality in the engineering workforce. In her critique of Western feminist scholarship, Mohanty (2003) argues that Western feminism has become complicit in neoliberal aims to “flatten” feminism and antiracism, focusing too singularly on individuals and ignoring historical factors and cultural particularities. Similarly, Kerner (2017) points out that even intersectional studies have become depoliticized over the past two decades, having lost the sharpness of their abolitionist origins, and stand to benefit from a global, postcolonialist perspective. This can be seen in the case of engineering scholarship, in which many studies generalize across the entire engineering discipline and across the U.S., as if civil engineering and biomedical engineering have similar cultures, as if engineering industrial opportunities are the
same in Kansas as in New York. The vast majority of engineering studies take place in Western contexts and fail to acknowledge the field’s role in the movement of global capital. The result is a version of engineering which has been “flattened” to presume mostly white employees who share a common “culture” across disciplines and across geographic locations and are bounded by a single nation’s boundaries. On the contrary, engineering - and particularly semiconductor engineering - is a global enterprise that is linked to neoliberal development, in which employees migrate internally and internationally and which varies widely depending upon where it is practiced, by region, by industry, by discipline and by company.

In the effort to bring the global scale of engineering into the frame, I am indebted to scholars who bring a transnational perspective to studies of engineering and high tech labor, articulating what Varma (2017) calls a “paradox of empowerment” for migrant women in engineering - in which women simultaneously earn freedoms not previously possible, yet become marginalized as they are uprooted out of their familiar surroundings and embedded in locations in which they are highly visible and vulnerable as minority (contingent) employees. Amrute (2016) articulates this paradox for Indian IT workers in Germany, showing that the German visa system, which was never intended to support such large numbers of essentially permanent employees, creates extreme vulnerabilities for Indian migrants. These immigrant IT workers navigate their identities amongst their sometimes-resentful German coworkers and neighbors, who oscillate in their views of Asian immigrants as either model minorities or economic pariahs. Shih (2006) notes the importance of membership in minority professional societies for Indian migrant workers abroad, showing how these transnational professional societies - such as affiliation with Indian Institutes of Technology (IITs) - enable employees to circumvent discrimination in Silicon Valley. Furthermore, Shih notes how Asian minority networks differ from the networks and pathways
common for white women, wherein white women find opportunities largely in multinational companies, while Asians find more opportunity in minority-owned startups. Studies of Indian women in engineering (Dutta 2017; Dutta 2016) and Computer Science/Information Technology (Varma 2017) reveal that the major constraint to choosing engineering is not young women’s interest in science, but rather, the patrifocal family structures which prevent them from entering the workforce after earning degrees. Radhakrishnan (2011) demonstrates Indian women IT workers’ enactment of “respectable femininity”, which allows them the additional freedom of a life abroad, while performing a recognizable “global Indian” identity and culturally appropriate adherence to domestic family responsibilities. Gu (2016) attends to the invisibility of Chinese women in American engineering universities, who she argues have been overly-simplified as “docile” and “obedient” engineers, but for whom there exists no single Chinese experience, but a wide variation due to undergraduate experiences, urban or rural geographic location, social status and family gender preferences. Most of these studies focus exclusively on migrants from a single country. For this work, I have felt it necessary to take a multicultural approach in order to capture the ties of belonging between employees from around the world in the semiconductor industry. Therefore, while it has been infeasible to conduct a truly in-depth analysis of a single geographic location, what follows is a high-level summary of structural forces experienced by my participants from a range of geographic locations, the pushes and pulls that drew them into semiconductors, and the constraints which left many behind.

Consider, for example, the histories of Kalpana and Wangshu, whose pathways into the “integrated circuit” demonstrate a confluence of pushes and pulls related to systems of national politics, labor, and kinship.

Kalpana (F, 30, India).
Kalpana had a metropolitan upbringing, the daughter of a microbiologist and a banker in Bombay. Her mother was a full-time professional throughout her childhood, an unusual arrangement for Indian families. While other kids went straight home after school, she and her brother would walk to the babysitter’s house instead. From watching her mother, Kalpana developed a vision of having a career of her own one day. “I always had this value of being financially independent,” she reflects, “and also the confidence to go out and earn for the family.” From her father, she learned a love of technology. “He was an engineer at heart, always taking apart the home appliances - even if they weren’t broken! Mom was sometimes not very happy about that,” she laughs. Kalpana was drawn to physics, but when her guidance counselor learned she was interested in a career, he pushed her toward engineering instead. Due to the extraordinary growth of the engineering and IT industries in India, it was almost certain she would get a job.

Kalpana chose a university close to home, having the benefit of many good schools in the area and feeling that she was not ready to move far away yet. Twenty-five of her fifty classmates were women - fifty percent, exactly - so she never felt isolated in school. Rather, women’s participation in engineering was curtailed in other ways - girls often had curfews that prevented them from attending evening events at the universities. “Some girls had to be home by 4pm,” she said. “I wouldn’t blame the parents, there were so many incidents. But sometimes they go overboard.” Furthermore, a lot of her classmates didn’t enter the workplace after graduation, feeling social pressure to start families instead.

For her part, Kalpana met her future husband, Chetan, early in college, but they decided not to get married right away. Instead, they applied to graduate schools in the U.S. Kalpana was lucky to have a professor who had gotten a degree in the U.S. who sparked her interest in
semiconductors. He wrote her a strong recommendation letter and helped her classmates craft their applications. They took advantage of local programs to study for the GRE and TOEFL exams. For the young couple, finding graduate programs close to each other was difficult. Their majors were different, for one thing - he was in biomedical engineering, she was in electrical. Plus, they wanted their independence. “We knew we would end up together, but we wanted to grow separately, we wanted to figure it out for ourselves.” They ended up choosing different universities in the same state, about three hours apart. When she graduated two years later, Kalpana had her heart set on a career in semiconductors. This field was a small, competitive, niche industry, so she knew she would need to be patient in her job search. Two months later, she got an offer for a semiconductor company in New York. Chetan chose a career as a technical entrepreneur - he has been successful, but startups are not profitable right away. Kalpana’s career has been the primary income for their family. “Those first 2-3 years I was doing it on my own. It was stressful, but I like that he has me to rely on and can do his thing. It is empowering. You look back and you say, those five, ten years, I was doing it on my own.”

*Wangshu (F, 38, China).*

Unlike Kalpana’s city life, Wangshu grew up on a small, subsistence farm in a region just outside Beijing. During her childhood in the 1980s, China was undergoing massive cultural change. Her parents were uneducated, barely finishing an elementary school education. However, a new law in 1986 mandated at least nine years of education for all children and there was a strong emphasis on science and technology careers for undergraduates. Wangshu was an exceptional student. She was not drawn to any subject in particular, but her teacher saw potential in her. Although her brother and sister dropped out before graduation, Wangshu’s teacher recommended she attend a prestigious teaching college in Beijing. Wangshu emphasizes the
importance of the mentoring relationship that developed between her and her teacher, “Sometimes teachers send their favorite students to their college in China. They think very hard for your future.” In the year before college, she dreamed of going to a university in southern China, traveling far away from home. But she knew this would be very difficult - her family could hardly afford tuition as it was. She enrolled at the university her teacher recommended without telling her mother, surprising her with the news one week before she was set to leave for Beijing. Her mother was upset at first, but in the end consented to let her go and was happy her daughter was granted the opportunity to continue her education.

On the recommendation of her teacher, Wangshu studied material science, a preparatory major for a career in the burgeoning semiconductor manufacturing industry in China. Of the twenty-six students in her class, nine were women. Despite women being somewhat underrepresented, she did not feel there was prominent gender bias in school - to her, it seemed as if the professors were equally strict on everyone. She met her husband at the university and they enrolled in graduate school together. After getting their Master’s degrees, her husband was immediately hired at a semiconductor factory. Wangshu, on the other hand, struggled to find a job in Beijing, finding she was overqualified for many of the government positions she applied for. She even tried applying for HR and sales positions but kept being passed over. “When you’re trying to find a job, it’s totally different [from college],” she says. “If you are a woman, you have to be very outstanding.” Managers are hesitant to hire women since they think they will be distracted by raising a family, she explained. Men are thought to be better investments.

Eventually, her husband transferred to the Shanghai area, where the semiconductor industry was booming. “Maybe I’m kind of lucky,” she reflects. “He got a job in Shanghai. So I said, oh it’s not difficult. Maybe I will just go to this fab for half a year and transfer to Shanghai and I can
“go to some other job that I like better.” She ended up staying for three years. It was a happy time for them. There were lots of young people working at her company and most lived in the same neighborhood. Wangshu and her friends would ride the shuttle to work and back, eat dinner together at the company cafeteria in the evenings and go on shopping trips on the weekends. Eventually, her husband was transferred to a manufacturing facility in Germany. Wangshu planned to continue to work in Shanghai, but she had just had a baby and found it difficult to be a single working parent. Six months later, she joined her husband in Germany as a stay at home mother. When her husband was transferred again two years later, this time to the U.S., she decided to return to work, finding a job at the same company. The transition has been difficult, but she is happier working than staying at home. When I ask what advice she has for women transitioning back to work, she says, “You must get out of your comfort zone. You know, I just try my best to do everything hard. If you never give up, you can always get what you want!”

Global Labor, Local Infrastructure

Although the women in these vignettes frame their stories as tales of personal triumph and empowerment, it is important to read between the lines to see the structural forces that influence their careers in substantial ways. Far from semiconductor engineering being a choice made entirely independently, women’s careers have been shaped by larger historical, political and cultural factors that incentivize some career options over others. At the same time, these “channeling” forces prioritize male employees and women have to fight much harder to stay in the pipeline. This section will attend to incentive structures in the following areas: (1) national and strategic priorities, (2) visa systems, and (3) education systems. These factors profoundly shape participation in semiconductor manufacturing, contributing to unevenness of access across the world.
National Industrial & Strategic Priorities.

Governments incentivize particular industries and career choices, positioning some careers as more desirable, more practical, more “thinkable” than others, and shape ideas about technical progress that are far from uniform cross-culturally. On one hand, the globalization of engineering practice has been largely driven by the United States, characterized by a focus on privatization and patenting of technical knowledge, a process that Downey and Lucena (2004) have called “philosophical colonialism” in the global engineering industry. On the other hand, significant variation exists between nations regarding cultural values and industry structures. From Germany’s belief that engineering and technology would capture the German “essence” of its hardworking people, to the UK’s tradesman-like approach with an emphasis on high quality craftsmanship, to the US’s tradition of low-quality mass production and individual patenting, each nation configures engineering industry to suit its own cultural values (Downey and Lucena 2004). These values shape who is pushed and pulled, mobilized and constrained from participation. For example, in her study of Chinese engineers, Gu (2016:160) notes that China’s Open Door Policy in the 1970s resulted in massive increases in educational achievement and that a small number of new universities created during this period have furnished the majority of Chinese engineers working overseas. Similarly, Amrute (2016:77) observes that India’s transition to a knowledge economy and partnerships with multinational corporations have resulted in Indians “winding up” in IT, regardless of degree program or personal preferences. This challenges notions of individual agency in career choice, demonstrating the impacts of the nation flexing its muscle in particular sectors and individuals simply taking advantages of “practical” opportunities made available to them.
The dominant narrative in the U.S. is that the nation is currently in a talent shortage for STEM occupations. Knowledge-based industries (KBIs) are projected to be a principle driver of economic growth and a critical part of maintaining American dominance throughout the world. There are indeed legitimate causes for concern. Since 2000, the U.S. has steadily lost ground in scientific publications, going from second in the world to third, trailing the European Union and China (NSF 2020:Fig 21). While the US continues to outpace the rest of the world in industrial output, China is steadily catching up (NSF 2020:Fig 24). Of greater concern is the workforce gap in engineering labor force: while the engineering workforce is projected to expand by 8.2% from 2016-2026 (NSB 2018:Fig 3-A) engineering employment is expected to remain steady at around 5%, resulting in an approximate 3% workforce gap (NSB 2018:Fig 3-3). The conclusion of the 2020 report ends on a grim note: “As more countries around the world develop R&D and human capital infrastructure to sustain and compete in a knowledge-oriented economy, the United States is playing a less dominant role in many areas of S&E activity” (NSF 2020). Some scholars contest the significance of these indicators (Gordon and Kimball 1985), arguing that the greatest growth areas in the U.S. are in healthcare and service industries. However, STEM disciplines maintain high appeal due to their association with global dominance.

As a result, government-funded agencies, such as the Department of Education and National Science Foundation, have included a substantial budget for STEM outreach. In 2019, the US Department of Education alone awarded $540 million to outreach programs (US DOE 2020). A significant portion of these awards are designated to target demographics with historically low participation in STEM, such as women, minorities and students from rural areas. Rossiter (2012) has framed the targeting of women and racial minorities in STEM as essentially a “greenfields practice” (Lynch 2007), in which industry scouts previously untapped labor to “fill
the pipeline” of vacant jobs. In STEM outreach endeavors, industry has enthusiastically partnered with government to attract new talent from these demographic pools since the late 1970s. Girls who were good in school were encouraged to try math and science through outreach programs at local colleges, middle schools and high schools. These programs glamorized the field of engineering, emphasizing its contribution to technological innovation, and encouraged young girls that, despite stereotypes that paint engineers as “geeky” or “for boys”, girls can do science too. However, in the United States, engineering still lacks the prestige associated with other professions such as medicine and law, a phenomenon that some scholars attribute to engineers’ dependency upon industry and management (Zussman 1985) and relinquishment of social responsibility as a core tenant of engineering ethics (Layton 1971). Instead, engineering is viewed as a “practical” career for students who want a guaranteed job after college with a good starting salary.

In contrast to the somewhat lackluster enthusiasm for engineering in the U.S., engineering has been a popular career path for middle class families in India. Khandekar (2013) argues that this is the result of a combination of a number of factors, including strong linkages between Indian modernity and science and technology, and frustrations amongst the middle class with the uneven growth of higher education and with political culture more broadly. Following a financial crisis in 1991, the International Monetary Fund (IMF) mandated economic liberalization as a condition for much-needed loans, specifically the opening of India’s markets to foreign investments. At this point in time, the World Bank and IMF had become captivated by the promise of knowledge economies, or economies based up on service- and analytic-work (WB 1998). Prime Minister Manmohan Singh in 2005 embraced the transition to a knowledge economy, promising it would allow the nation to “leapfrog” past the industrial development stage
into a fully developed nation on the global stage (Radhakrishnan 2011:37). While India had struggled with the high initial investments required for industrial development, the nation was uniquely suited to take advantage of knowledge economy developments with its surplus of human labor ready to be deployed in the new technological sector. New private sector investments frequently came in the form of “offshoring” or “outsourcing”, in which US and European companies flocked to India to set up offices where cheap, routinized labor could be outsourced for approximately one-third the cost of similar talent in the U.S. (Radhakrishnan 2011:36). Although initial positions in the new IT sector were considered low-skilled, routine work, over time, the field has become a two-tiered structure, encompassing low-skilled, routinized call center labor and high-skilled, increasingly specialized IT positions (Varma 2017). The software industry experienced significant growth during this era and specializations in semiconductor applications emerged as a highly-coveted role that could rocket employees into the global labor circuit. In this “new India”, technical occupations in the IT sector became a new national symbol of elite status (Radhakrishnan 2011:42). Ravishankar (M, 44, India), a software engineer who worked in Bangalore during this period, reflects, “Like me, everyone was being absorbed by these companies at that time.” Software engineering jobs were good jobs, he recalls. Employees worked in plush, modern office parks with air conditioning and other luxury amenities. Furthermore, engineering work at these companies paid more than jobs in marketing and sales. In Kalpana’s (F, 30, India) experience, her guidance counselor would have noticed the growth of this industry around the time Kalpana was choosing her career path. Seeing her interest in building a career, he steered her into engineering, understanding that an engineering degree would be more valuable to these new IT companies than the physics degree she had initially preferred.
Science and technology have similarly been perceived as critical to the project of modernization in China, although its development followed a different trajectory due to the immense cultural and political changes over the past century. In the 1940s, communism and its rejection of rigid Confucian social hierarchies gained popularity in China, promising greater equality for Chinese people. However, the Chinese Communist Party during the Cultural Revolution (1966-1976) reneged on many of these promises (Gu 2016:56–57). Cold War animosities between capitalist and communist nations produced heightened suspicion of capitalist spies in China, resulting in anti-intellectualist sentiment and closures of numerous universities across the country. This period is largely remembered by modern Chinese as a period of economic and intellectual stagnation (Gu 2016:56). In 1977, following the end of the Cultural Revolution, President Deng Xiaoping vowed to set the country on a track of economic liberalization and modernization in four key industrial sectors: agriculture, industry, defense, and science and technology (JEC 1982). Xiaoping’s labor reforms reduced the nation’s reliance on state-owned enterprises, opening the door to neoliberal expansion of privately-owned companies in China. In the past three decades, the Open Door Policy has provided a framework for privately-owned and foreign-investment enterprises in China as the country moves toward a free-market economy (Chen 2012:11). High-tech companies seeking to manufacture technologies cheaply overseas established partnerships in China (Tinn 2011; Chu 2013). Specifically, semiconductor manufacturing has been targeted in the recent Made in China 2025 (“MIC 2025”) plan, with China planning to ramp up its production infrastructure and close the “innovation gap” (Liu and Duhalde 2018). MIC 2025 also draws upon the concept of “leapfrogging” to a knowledge based economy in order to situate China as a world leader in intellectual property (IP) (Ernst 2016). Furthermore, the manufacturing sector has become an “employment absorber”,
with job growth in this sector reaching as high as 29% of the population in 2015, far outpacing the percentage in other leading nations (Ernst 2016).\(^2\)\(^3\) Although China has lagged behind the U.S. and Taiwan in its R&D efforts, the demand for semiconductor products (i.e. cell phones and electronic devices) in China far outpaces every other country in the world ($213.8 billion/yr in China v. $40 billion/yr in the U.S.) (Liu and Duhalde 2018), and China plans to keep more of the design and manufacturing process in-house. These national priorities have resulted in a pipeline of students like Wangshu, majorsing in fields such as materials science and chemical engineering which feed directly into the burgeoning advanced manufacturing sector.

In contrast to migrants from India and China, who are situated upon well-traversed paths of the semiconductor labor force, several of my participants, like Naomi (F, 37, Bangladesh), were from countries that did not have clear pathways to the semiconductor industry. Naomi’s home country of Bangladesh is also attempting to “leapfrog” to a knowledge economy; however, it has struggled to pivot from its reliance upon rural agricultural production, which employs nearly half the population (CIA 2020), and develop a skilled labor force (Latifee and Hossain 2018). Also a formerly socialist country, Bangladesh has been following the path of industrialization and economic liberalization since the 1980s, primarily through the development of the textile and garment manufacturing industries (CIA 2020). Beginning in 2008, the Digitalize Bangladesh initiative has prioritized partnerships with IT firms for outsourced labor (Mazumdar and Alharahsheh 2020). While supporters of this endeavor promise future growth in this industry, it still accounts for less than 1% of GDP and faces challenges in the development of digital infrastructure and skilled labor (Latifee and Hossain 2018). Engineering graduates in

\(^2\) By comparison, the U.S. manufacturing sector employs approx. 10% of the population (Ernst 2016).
\(^3\) Reliable Chinese employment data is difficult to obtain due to lack of robust and transparent national employment tracking.
Bangladesh are more likely to be routed into mining or garment industries than to pursue careers on the leading edge of advanced manufacturing (Chowdhury et al. 2008). This is what Naomi means when she describes herself as feeling “channeled” into a career she did not herself choose. Initially after her graduation, she found work in the garment industry and later in government inspection. Her career was not entirely restrictive; the opportunities afforded to her through her education and experience granted her additional avenues for personal agency. Her husband’s financial success as an engineer and later a manager in a garment factory was a critical factor in the couple’s ability to pursue their education overseas. This constituted a major career change for the couple; there are no degree programs in semiconductor technology in Bangladesh, as there would be in China, nor are there paths to specialization in semiconductors in the workplace, as there are in India. They began their graduate school in the U.S. lacking much of the specialized knowledge that their peers might have already obtained.

**Immigration Policies.**

In addition to policies and priorities set within countries, the lives of immigrant workers in semiconductor engineering are profoundly shaped by immigration policies between their home country and the destination country. In the United States, there are three major immigration pathways into the U.S. semiconductor industry: (1) through educational programs on an F-1 visa (usually graduate degrees, but for wealthier families, undergraduate education is also possible), (2) through temporary work visas, usually the H-1B, and (3) through expanded employment-based permanent resident opportunities for skilled workers (Shih 2006).

In the first scenario, students apply to colleges and universities in the U.S. in order to gain access to the academic, research, and employment opportunities available. This is most frequently through graduate degree programs. Families with greater wealth may be able to afford
undergraduate education, but this option has declined as college tuition in the U.S. continues to rise. While some students plan to return to their home country, many are hopeful that they will be hired by an American company after graduation.

In the second scenario, semiconductor employees are hired directly from companies overseas. The initial employment period is temporary, but it can be renewed at the employer’s request. High-tech companies heavily rely on this channel to fill specialized positions (Shih 2006:193). While in the past, the U.S. has increased the caps on H-1B employees to as many as 195,000 per year in 2001-2003, these caps have been stable since 2006 at 65,000 plus an additional 20,000 for students transitioning from an F-1 visa category (AIC 2020). In order to fill employment gaps, companies may turn to other visa categories, such as the J-1 visa for temporary hires, ostensibly for training purposes, and the L-1 visa, which is restricted to intracompany transfers. Importantly, the poorly regulated J-1 and L-1 categories are not subject to labor protections such as the prevailing wage requirements in the H-1B (Justice in Motion 2015a; Justice in Motion 2015b).

The third option, permanent residency, or green cards, for skilled employees, is rarely accessible to engineers working abroad, but is more likely pursued while the engineer is already employed on an H-1B visa in the U.S. Most semiconductor engineers qualify for the skilled employment categories, EB-1, EB-2 and EB-3, all of which are highly competitive brackets. However, this is one place in which immigrants from countries that have lower rates of immigration have an advantage. While Indian and Chinese immigrants like Kalpana and Wangshu are eligible only for the EB categories, Naomi, being from Bangladesh, would be eligible for the Diversity Lottery, which is currently capped at 50,000 per year (BPC 2014).4

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4 Trump temporarily suspended this program and slowed H-1B progress. And Indian permanent residency has been broken for years, with many Indians waiting upwards of 10 years for a green card.)
These policies in the U.S. impact who is eligible to work and who is able to remain to pursue a long-term career path and perhaps eventual path to citizenship. However, it is only half the story, as it does not fully answer why migrant pathways for some countries are more heavily travelled than others. The way that these policies interact with policies from immigrants’ home countries also impact the flows of labor in semiconductor engineering, creating pushes and pulls for migration.

While the Indian government has largely succeeded in its efforts to “leapfrog” into a knowledge economy and created strong incentives to obtain an education in science and technology, the number of college graduates outpaced skilled job creation contributing to a mass emigration out of India, known as “brain drain” (Khandekar 2013:182). In addition, the practical career paths enabled though offshore partnerships offered limited professional mobility and creative autonomy, leading Indian IT workers to search for growth opportunities abroad (Radhakrishnan 2011:38). Simultaneously, Indian middle class citizens were dismayed to find that strong affirmative action laws mandated that fully 50% of state-sponsored universities be reserved for “backwards classes” or BCs, limiting their children’s ability to get into the highest ranked college programs (Khandekar 2013:183). Seeking a high quality education, wealthy and middle class students began to explore education abroad. Simultaneously, a change in U.S. immigration law (the Immigration Act of 1965) allowed immigration, particularly for skilled immigrants, from Asian countries for the first time since The Chinese Exclusion Act of 1882 (Khandekar 2013:187). The synchronicity of the change in American policy with the Indian upper class’s search for high quality education and job opportunities established a strong tradition of education abroad in India, with a preference for American institutions. Careers abroad, and the corresponding creative transformation from repetitive workers to specialized
analysts, have become a bridge from what Mohanty has termed the “Two-Thirds World” to the “One-Third World” (Mohanty 1984), establishing migrant technical labor in India as a highly coveted profession (Radhakrishnan 2011:49) and breaking in multiple well-trodden pathways of migration between India and the United States.

In China, Deng Xiaopeng’s Open Door Policy with its emphasis on foreign cooperation and free markets, encouraged migration abroad for work and education opportunities. Perceiving that China lagged behind the U.S. in scientific progress, graduate students were encouraged to seek educations abroad, in Europe, and later in the U.S. (Gu 2016:160). Chinese migrant pathways are facilitated through guanxi networks, which expedite entry into graduate schools and career networks abroad (Gu 2016; Shih 2006). In these exclusive networks, only the highest ranking Chinese students from select universities will have the opportunity to study abroad - of the 2,200 universities in China, the majority of Chinese scientists & engineers are graduates from just 10 high ranking institutions (Gu 2016; Zhu and Cox 2015). These institutional affiliations form an important layer of the “meshworks” (Gu 2016:169) that make up the guanxi networks in the Chinese diaspora, which help facilitate entry to graduate school and career hopping in the U.S. and abroad. Early migrants to the U.S. in the late 1970s were typically mid-career scientists seeking to specialize in a particular branch of technology, and frequently had intentions of returning to China after their education. The popular idiom “sea turtles return to China” indicates the duty of Chinese students to one day return home, wielding the knowledge acquired abroad to benefit the nation (Gu 2016:141). However, in recent generations, college graduates are choosing to pursue graduate school in the U.S. in dramatically higher numbers, nearly a sixfold increase in enrollment in the U.S. between 1975 and 2010, and many hope to stay permanently (Gu 2016:174). Shuang (F, 31, China), a young engineer who plans to stay in the U.S. explains the
attitude shift of her generation: “Everyone has an American dream. There is more freedom here, you can be more of yourself.” In the semiconductor field, competition between American and Chinese companies is fierce; distrust and secrecy haunt communications across the Chinese border (Chu 2013). However, despite these obstacles, skilled labor in semiconductor manufacturing is in such high demand that numerous Chinese employees are hired by U.S. and European semiconductor companies around the world.

Participants from off-the-beaten-path of the semiconductor engineering labor market, like Naomi, lack the benefits of migrant networks, resulting in career paths that were more meandering. Although the same major pathways are available – through education abroad and industry internal transfer – these paths are more difficult to access. There is, for example, a program in Bangladesh for exceptional university students to explore education abroad, but only the top few students in each class are eligible. Furthermore, by the time Naomi and her husband were ready to make that transition, they were beyond college and well into their careers.

Successfully navigating the visa system is final hurdle for employees who wish to stay in the U.S. permanently. Not all migrant engineers will choose to do so. Indeed, the bureaucracy and hopelessness of the green card permanent resident system, combined with a desire to escape the “rat race” of U.S. employment is pushing many migrants to return home, even if they initially intended to stay, a process that Radhakrishnan (Radhakrishnan 2011:33) has termed “brain circulation” as opposed to “brain drain”. However, for migrant engineers who wish to stay in the U.S., their status depends entirely upon being able to secure a job in their narrow area of expertise on an H-1B visa. Foreign students, upon completion of their degree program, must find a company that hires foreign employees, and this can strongly influence which industry they find employment in. Although some students, like Naomi, initially have a strong interest in
semiconductors, many, like Kalpana, choose a more generalist major to keep their options open. Kalpana obtained her Master’s degree in Electrical Engineering. She had heard there was a new manufacturing facility ramping up employment in New York who were hiring H-1B employees. It was not directly related to her research, but the company was looking for employees with graduate degrees, so Kalpana was happy to switch her focus. For some students, the transition from school to industry is more disappointing. Shuang (F, 31, China) had hoped to use her chemical engineering degree to get a job in the cosmetics industry but was told by American cosmetics companies that they don’t hire foreign employees. They referred her to their Shanghai branch, but she wanted to stay in the U.S. Instead, she ended up in semiconductors, which has a greater demand - and more limited supply - for employees with graduate degrees.

**Education Systems.**

In addition to the importance of national strategic priorities and immigration policies, pathways into prestigious semiconductor engineering careers are also constrained through access to high quality education, and specifically graduate-level education, which is unevenly distributed in developed and developing nations alike. Although college education is widely available for American students, engineering is a very rigorous degree program. Access to higher education was expanded through the Morrill Act of 1862, which permitted universities to be built on federal land in rural areas, focusing in particular on agriculture, science, military science and engineering. Known as “land grant universities”, these institutions are still considered crucial for the distribution of education to rural areas of the U.S. The field of engineering, in part due to its inclusion in the Morrill Act, has become associated with social mobility for populations from low socioeconomic backgrounds. However, despite the promise of this field, many students drop out, and retention of women and minorities is an ongoing problem, with only 21.5% of
engineering undergrad degrees awarded to women, 11.9% to Hispanic Americans, and 4.2% to Black/African Americans (NSF 2020:Fig 2-9, Fig 2-10). Among a host of ongoing research regarding why retention rates are so low in engineering, of note in this chapter are the high standards of educational and professional rigor which produce criteria through which women and racial minorities are routinely eliminated (Slaton 2010; Oldenziel 1999). College entrance exams in the U.S. require strong math skills at the high school level in order to become eligible for engineering undergraduate programs. Once admitted, students enroll in a highly structured progression of math and physics-based coursework, complemented by life sciences and technical electives depending upon the disciplinary specialty. These rigorous admissions criteria and coursework have been shown to serve less as a predictor of students’ capability as engineers than as a reflection of the resources they have had access to, reproducing systemic race, class and gender inequalities.

The majority of engineering students in the U.S. stop at a bachelor’s degree and find work in a range of industries, from aerospace to petroleum to transportation. Only a small percentage of American students go on to get graduate degrees, which are a requirement for emerging technologies like semiconductors. In 2017, only 29.5% of the total engineering degrees awarded were at the Master’s level and only 5.5% at the doctoral level (NSF 2020:Table S2-1). Of these, Americans represent only about 43% of graduate degree recipients (NSF 2020:Table S2-9, S2-11). Given these low graduate degree rates, semiconductor companies face a limited supply of qualified applicants and, therefore, rely heavily on hiring foreign students. However, American graduate students are preferable to U.S.-based semiconductor companies, who are keen to show that despite a high volume of foreign employees they are making an effort to hire American workers (Rulison 2019).
The Indian education system is also stratified between urban and rural areas and across class boundaries. Post-independence India established a strong commitment to higher education, specifically tying science and technology as key to India’s desire to modernize. However, while the new knowledge economy has been framed as accessible to all, education and technological skills are available to relatively few, who tend to be overwhelmingly urban and upper caste (Radhakrishnan 2011:8). The Indian education system is highly competitive and college engineering enrollments are extremely so. At the end of their secondary education, Indian students sit for college entrance exams; those who score highest get their first pick of colleges and majors. Placements in engineering and computer science majors, seen as leading to highly desirable “practical” careers, fill up quickly. Students in the middle of the pack must settle for a second-choice major or school. Although 50% of positions at state-sponsored universities are reserved for lower-caste students, wealthy upper caste families are able to get around these barriers through donations and networking. Reflecting upon his inability to get into his degree program of choice, a high-caste Brahmin engineer, Ravishankar (M, 44, India) tells me he could have asked his father to pull strings to get him into a higher-ranked school, but he was disgusted with the process and did not want to buy his way in. He settled for a less prestigious regional school. “Education serves as a central field through which class segregation is perpetuated,” Radhakrishnan (2011:42) writes, pointing specifically to urban location, caste, and language as critical barriers to educational achievement. Kalpana, in this case, was fortunate to be born in Mumbai, where there were plenty of good universities. Although she did not get into an IIT, she was able to get a good education without traveling too far from home. For Ravishankar, who lived in Chennai, the options were more limited; he would have needed to move to the more
centrally-located Bangalore to attend a better school, which he felt unable to do due to his commitments to his family.

When it comes to choosing graduate schools, the quality of Indian higher education is perceived by Indian students to be sub-par in comparison to U.S. and European schools (Khandekar 2013:190). India has a well-distributed system of regional colleges with the goal of providing opportunities for education to rural areas as well as cities. However, in contrast to the American liberal education model, with the exception of the extremely prestigious IIT universities, Indian colleges provide a standardized education with little variation across regions. Indian professors are not guaranteed to have PhDs or ambitious research agendas and there is not as much one-on-one attention for students as in the U.S. The conclusion drawn by ambitious, high-performing students like Kalpana is that unless they get into an IIT for graduate school, their degree will not be as prestigious and they might as well study abroad, where they will have access to better research facilities and stronger connection to industries.

In China, the Open Door policy necessitated dramatic changes in education policy to counteract the previous era of anti-intellectualism and correct educational inequalities, particularly in rural areas where literacy rates were as low as 20% prior to reforms (Plafker 2001). In 1986, the government mandated nine years of compulsory education for all Chinese children and reopened universities that had previously been closed. In 1995, to accelerate the progress of Chinese higher education, Projects 211 and 985 strengthened the programs of over 100 universities to become more competitive with institutions abroad (Zhu and Cox 2015). The project resulted in a massive increase in PhDs granted from Chinese universities, from only a handful granted in 1970 to over 24,000 in 2004 (Gu 2016:185). The effort to produce world-class universities in China continues with the 2015 World Class 2.0 project, which touts improvements
in undergraduate teaching and research (Lee, Godwin, and Nave 2018). For students such as Wangshu, who grew up during this cultural shift, science and technology subjects were given strong cultural preference. Given the rapid scale of economic change and their parents’ unfamiliarity with the education system, Chinese students, particularly in rural areas, relied on their teachers to help them choose a career path. Wangshu felt she had little understanding of what was possible with an education. She reflects, “Before I entered college, I knew nothing. What could I be? I don’t know. What can I do? No. I don’t know.” Another Chinese engineer of this generation, Yu Yan (F, 41, China) tells me a funny story about how she selected “vehicle engineering” as a major, believing it was the most prestigious one, without ever having ridden in a car before! When she graduated, she realized she knew nothing about automotive design, and decided to get a second bachelor’s, this time in semiconductor engineering.

Like in India, early academic competition in China is intense. The “one chance” examination systems for both high school and college selection offers only one opportunity to get into a good school, contributing to high levels of focus amongst students from a very early age (Gu 2016:37). Shuang (F, 31, China) describes her experience in “rocket classes”, which were catered to the top-performing students. To keep your spot, you had to hold your position at the top of the class, otherwise you would go back to the “normal” classes. Parents contribute an additional layer of pressure, knowing that education will change the trajectories of their children’s lives. Students with high scores are eligible to attend prestigious universities and major in engineering specializations. Chinese students who do not score high enough, or simply have a stronger interest in vocational schools, are rerouted to polytechnic institutes in areas such as forestry, agriculture, legal services, or carpentry.
For both Chinese and Indian students, there are support structures for crafting applications for universities abroad, although the process is by no means easy or guaranteed. Most of the Indian and Chinese engineers I spoke with who came to the U.S. on an F-1 visa were able to take advantage of resources that prepare students for the GRE and TOEFL exams. The well-established Indian and Chinese diasporas in the U.S. provide structural support for students looking to travel overseas. Family ties and guanxi networks are core factors to students’ mobility and access overseas (Gu 2016). Several of my participants had family members or friends abroad who would provide advice on where to apply and how to get into schools. Institutional networks associated with prestigious universities, such as the IITs, are particularly useful for forging connections across continents (Shih 2006:198). Less commonly, a few students had professors who had studied in the U.S. and could help them craft their applications. The personal essays and statements of purpose were particularly difficult. Kalpana explains that this was an unfamiliar challenge: “This required a more expressive background. It is an essay about yourself.” Shuang (F, 31, China) agrees. “They want to know you as a person, not just your top score. So you need to justify your qualification, why you want to be here, study this, what you want to do after this.” By utilizing the resources widely available through peer study groups, both Kalpana and Shuang were able to craft applications that were accepted at multiple American universities.

After acceptance to a university comes a final hurdle: the visa office. Students have to interview with a visa officer, who screens for only the most exceptional candidates. “It seems totally random,” Farhan (M, 32, India) reflected on his visa interview. “Several students who had better grades and qualifications than me didn’t make it.” As a part of this procedure, applicants must be able to show that they can afford to live in the U.S. without assistance for the duration of
their program. After this rigorous screening of exams, language fluency, essays, and proof of financial independence, only a privileged few are granted the opportunity to study in the U.S.

Although the U.S., India and China endeavor to distribute education evenly across the nation, some nations are further behind in this effort. Naomi’s home country of Bangladesh has undergone a massive increase in literacy rates since the 1980s, from only 29% in 1981 to nearly 74% in 2018 (WB 2018). In 2010, the government increased the compulsory school requirement from only five years to eight. Naomi describes this as a dual effort to improve literacy and to curb child labor, which was officially outlawed in 2006 but remains difficult to enforce. In 2018, 20% of students dropped out before completing elementary school and 38% before completing high school. However, the disparities between urban and rural education access and quality are stark due to poor infrastructure and lack of funding (Trines 2019). The universities are nearly all located in the capital region of Dhaka (Chowdhury et al. 2008); Naomi’s home region of Khulna had only 3 public universities nearby, none of which offered an engineering program.

Engineering education is only offered in a few select universities, all located in Dhaka. There are only 6,000 openings in engineering each year, a number which may go partially unfilled due to the confusing non-standardized “admission battle” in which many qualified students may be unnecessarily eliminated (Chowdhury et al. 2008:939).

Bangladeshi engineering students who succeed in their engineering programs have a number of local industries in which to find work, including the garment, leather and textile industries. However, due to limited growth opportunities, educated students are highly motivated to find work or continue their education abroad (Trines 2019). Naomi became part of a surge in international students, increasing from only 15,000 in 2005 to 56,000 in 2017, who, as part of the emerging middle class in Bangladesh, found they could afford an education abroad. In this study,
I found that students from nations “off the beaten path” of the tech industry relied more heavily on individual personal connections who facilitated university applications and study abroad, differing from the widely-available support structures for crafting application materials in India and China.

**Additional Obstacles.**

In the previous sections, I have laid out a general foundation for how students and employees’ from different parts of the world find their way into semiconductor engineering. Briefly, I also want to mention some common, but significant, hurdles that foreign students and employees face when they arrive in the United States.

Fluency in English is difficult for migrants from all backgrounds, but particularly for Chinese students and employees. Although younger generations of Chinese students grow up learning English in schools, similar to the way American students learn Spanish or French, they do not attain the level of fluency that many Indian students do. In India, English is an everyday alternative to regional languages, particularly in the southern states; many schools teach in English and it is a requirement for work in some companies. This is not the case in China. Chinese students struggle especially with the verbal portion of the GRE and the TOEFL exam. “No matter how much English you learn [in China], it’s different here,” Shuang says matter-of-factly. International students are sometimes offered an additional year of language training in the U.S. as part of their graduate program, but this is additional time that cuts into work on the graduate degree.

Foreign students are also more susceptible to academic bullying due to their vulnerable position. Many graduate students, both American and foreign, found it difficult to evaluate graduate programs from afar. For some, it was a matter of avoiding particular research advisors;
for others, entire departments were toxic environments. Most of the stories I collected about graduate student abuses were second-hand, or things my participants reported observing with other students; only a couple admitted to being bullied themselves. For example, one advisor didn’t tell a postdoc they had been let go, leaving them to figure it out when they stopped receiving a paycheck. Another advisor tried to cheat a student out of a patent they had helped develop. Teresa (F, 37, White American), who witnessed the harassment of several international students in her program observes, “It’s a bias against weakness. [This advisor] saw that these students were dependent on him in a way that American students weren’t. He could use their ideas and take credit for them.” Few international students have the knowledge and resources to recognize and respond to harassment in their graduate programs. Ilma (F, 40, Pakistan) asserts, “[All students] should be given anti-harassment training [in grad school] like we do when we start a job,” she tells me. “They should be given that. Every student.”

Gender in Semiconductor Engineering

In the previous section, I traced the normative pathways that shape who is and is not able to pursue a career in semiconductor engineering. While these pathways are common for both men and women, women face additional obstacles related to gender and family. In their study of migrant workers traveling between Singapore and China, Yeoh and Willis (2005) observe that skilled international migrants “tend to be treated as highly mobile individual male careerists circulating in an intensely fluid world of inter- and intra-firm transfers and career mobility, and discussed as if they are non-gendered beings who do not form a part of the household” (2005:212). Women are frequently an overlooked minority in the skilled professions and they do not have the luxury of separation from their roles in the family. In both of the vignettes in the
previous section, women’s journeys are marked not only by the policies at the national level, but also by the cultural requirements and preferences placed upon them as women.

Studies of gender in engineering in Western countries predominantly focus upon gender performance and cultural perceptions of masculinity and femininity, however, transnational scholars have pointed out that these studies are often Anglo- or Eurocentric. Some of the most critical barriers for non-Western women are related to patrifocal institutions that restrict women’s access to education and careers (Varma 2017; Dutta 2017). Patrifocal systems, in which men are presumed to be the primary economic earner and head of household, are infused into a variety of cultural institutions, from nation-states, to universities, to corporations, to families and local communities. The nature of women’s subordination is subject to cultural particularities, whether expressed through Confucian values of duty, honor and obedience in China (Gu 2016; Chen 2012) or through cultural understandings of “good families” and “good backgrounds” in India (Radhakrishnan 2011). Women are principally charged with upholding the traditions and cultures of the family. They may venture into skilled migrant labor, but only so far in as their duties in the home are adequately fulfilled. Tensions arise at critical junctures in women’s pathways to become engineers, as they oscillate between their desires for empowerment, women’s equality, and personal fulfillment and their desires to be good daughters, wives, and mothers. In many cases, their career goals are required to take a back seat to their responsibilities in the family, resulting in many women dropping out before their career goals are met.

Furthermore, some aspects of the gender-kinship system in one’s place-of-origin often contrast with the gender-kinship system found in the U.S., which holds different expectations of family roles and different measures of masculinity and femininity. Women working
transnationally must therefore balance the gender expectations of their overseas family members with the expectations of their coworkers and friends in the U.S. Strong families, in particular, become a central node along which migrant workers seek to reconcile their ethnic and transnational identities, contrasting themselves sharply with “deteriorating” Western families. Radhakrishnan observes that in tensions between “global” and “Indian” identities, “it is invariably middle-class Indian women who feel responsible for this reconciliation” (2011:11). In this sense, women engineers who immigrate to the U.S. occupy a borderland with respect to gender, with one foot in their country of origin and one foot in the U.S., and are responsible for structuring the ethnic identity of the entire family.

In this section, I highlight the patrifocal structures that significantly impact women’s education and access to careers in the semiconductor industry. Critical factors in women’s access to the transnational semiconductors workforce include: (1) girls’ access to education, (2) timing of marriage and children, (3) cultural perceptions of careers that are suitable for women, (4) cultural perceptions of women’s safety, and (5) cultural perceptions of masculine and feminine traits, skills, behaviors and dispositions. By participating in skilled professions, like engineering, women are empowered by their access to new career opportunities, but this does little to destabilize existing gender norms and women face enormous challenges if they are to succeed (Varma 2017; Yeoh and Willis 2005).

**Access to Education.**

One of the earliest obstacles to women’s careers in semiconductors is getting an education in science and mathematics. For Naomi, growing up in Bangladesh, this was more difficult than it seems, as Bangladeshi families and communities are strongly patrifocal. “Serving your family is a big part of your life,” Naomi says, struggling to find the words to explain to me,
a white Western woman, a world in which one’s uncles have the power to decide that their nieces should drop out of school to take care of the family. Such was the case for Naomi’s mother, whose own mother died when she was young, leaving the household devoid of its matriarch. Naomi’s mother left school early and married a man of her uncle’s choosing. Her husband, Naomi’s father, did not approve of paid work for women. This is characteristic of what many of my participants call “conservative families”. The category spans national boundaries and could be found as easily in India and China as in Bangladesh. Even the U.S. has its own variations of “conservative families”, although they tend to be isolated in extreme religious circles and perceived as “outsiders” to much of normative American culture. The Chinese version of “conservative families” is rooted in the Confucian class system, in which women are an underclass positioned below the social stratifications of men. Under the concept of filial piety, women may be pressured to perform nearly 100% of the housework, childcare and elder care responsibilities (Gu 2016:14). In extremely conservative Chinese families, education of daughters is considered a wasteful expense (Chen 2012:3), since the daughter will someday leave her maternal family and become an asset for her husband’s family. On the Indian subcontinent, individual ambitions for all family members are subordinated to the needs of the family. “Children are supposed to depend completely on the family for their personality growth and career development while valuing family loyalty, integrity and unity,” Varma (2017:48) writes, clarifying the distinction between Western and Indian upbringing. Within these East and South Asian basic frameworks, there is variation in interpretation from families that allow their children a great deal of personal freedom to families that follow traditional practices quite closely. Dutta (2016) notes that this varies with socioeconomic status; upper class families tend to be more flexible and lower class families more rigid as it relates to gender roles. However,
there are variations within castes and communities depending upon the family’s social and religious leanings.

Despite being born into a strongly patrifocal community, Naomi’s mother nonetheless instilled in her daughters a will for financial independence. Naomi’s father may have disapproved of women working for wages, but her mother worked anyway, along with many other women in her community who sold goods in the local market for extra income. Naomi observed that women who worked were able to put money away for their children’s education. Rather than having to consult their husbands, women could spend their own pocket money without requesting permission first. Additionally, these women were treated with more respect from others in the community.

Therefore, when Naomi went to school, she dedicated herself to doing well. Education in Bangladesh, especially for girls, is inconsistent, particularly in rural areas. In 2017, over 42% of girls dropped out before finishing high school (Trines 2019). However, Naomi became one of the beneficiaries of the late-1970s national prioritization of education, buoyed by her mother’s example. When several of her female classmates dropped out after fifth grade, Naomi kept going. “Obtaining an education means people respect your preferences,” she says emphatically. She passed her tenth grade exam with the third highest score in the city. Following this achievement, she attended her local college in Khulna, which is equivalent to 11th and 12th grades in the U.S. She graduated with high recognition, qualifying her for a scholarship in Dhaka, the capital city, which was one of the few places in the country to get a degree in a STEM discipline. Naomi was a success story, but for each girl in Bangladesh who succeeds, there are many more who are left behind.

Timing of Marriage and Children.

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In the ongoing tension between women’s career ambitions and family responsibilities, the timing of marriage and children is of critical importance to a woman’s ability to pursue her education and career. Access to an equal education has been a hard-earned victory for women in South and East Asia, but too frequently education is treated as an accessory, subordinated to women’s role in the family. Early feminist victories in China guaranteed women access to an education, the ability to work outside the home and permitted them the opportunity to choose their own partners (Chen 2012:5). However, in subsequent generations, women’s employment has acted as a “safety valve” or a “removable ornament” (Chen 2012:5), in which women fill vacant positions for a limited period of time but are encouraged to relinquish those positions as soon as they are needed by men. In India, girls’ education was originally imagined not as a pathway to a career, but as a way to improve their marriage prospects through the development of household and social skills (Varma 2017:47). There remains a normative expectation in Indian households that women will use their college degrees not to find work, but rather to negotiate a good marriage and start families.

The degree of freedom women have to negotiate their marriages is linked to the “conservative” leanings of one’s family and local community. In India, although women now have a greater degree of choice than in the past, women’s decisions about their futures are not entirely their own but require the approval of their families and their potential partners’ families (Varma 2017). It is now trendy for Indian women to get degrees in math and science to improve their marriage prospects. The husband’s family gains elevated stature from having a highly educated wife and daughter-in-law; the woman’s family gains a wider range of possible matches and the opportunity to be more selective. In some cases, women are able to work in IT firms for a few years before getting married in order to build some financial independence, which further
adds to their degree of selectivity in choosing a partner (Varma 2017:38, Radhakrishnan 2011:11). Engineering, however, in contrast with the physical and life sciences, is a less common choice for girls. In India, engineering is a rebellious choice since it deliberately signals their intention to pursue a career. Their employability grants them greater independence from their families, helping them evade their parents’ plans for marriage (Varma 2017:38).

The first major point of negotiation is marriage - when to get married and who decides. Arranged marriages are common in India, and this becomes a negotiating point for young women seeking to extend their education. A compromise might be struck, for example, that a young woman will be allowed to go to graduate school abroad if she agrees to let her parents choose her spouse (Dutta 2017:349). For Kalpana, her ability to study abroad was more acceptable to her family since she had already committed to marrying Chetan and they were traveling to the U.S. together. By demonstrating her commitment to her family role in the future, she was able to choose her own partner and push her marriage date beyond the typical 25 years of age in order to complete graduate school.

Durriya (F, 29, India) was more devious in her evasion of her parents’ plans for her future. She studied for her GRE and TOEFL exams in secret and did not tell her parents she had applied for overseas institutions until after she got her acceptance letters. “They were so angry,” she says. “They said to me, ‘Why did you do this?!’” To ameliorate her parents’ fears, she promised that she would only be gone for two years. Her parents consented to let her go when she agreed to start looking at marriage proposals online. Once in the U.S. and out of their direct control, Durriya stayed to pursue a PhD, and then accepted a job in the U.S. Pushing the envelope still further, she refused all attempts at an arranged marriage, eventually marrying a
man of her choosing at 30 years old. By this time, Durriya’s financial security had put her in a position to be able to push back against her parents’ objections.

In China, parents have less direct control over their daughters’ futures through arranged marriages; rather, women face more subtle social pressures to be obedient and deferential to their parents (Gu 2016:35). Rather than allowing or disallowing girls to enter certain careers, Chinese women are steered by their teachers and family members, with the presumption that they will choose to comply. Mingzhu (F, 30, China) describes a difference between how her father treated her and her brother. “I’m a girl, so my father - (pause) - took care of me too much. At the beginning when I was young, he made decisions for me, and even still now he’s still assisting me. Instead of just allowing me to make decisions by myself.” Her father insisted that she study mechanical engineering, his own occupation, and he selected the college she should attend abroad, directives that she followed without a lot of questioning at the time. Only now does she realize how many decisions she allowed him to make on her behalf. This is consistent with Wangshu’s description of her own choice of engineering as due to the subtle steering by her teacher. Her desire to be a dutiful student and daughter, combined with the aforementioned lack of knowledge about what was possible with an education, prevented her from acting on a more reckless impulse to go to a school far from home.

This decision of when to start a family is a second point of tension, since this would typically coincide with a woman’s graduate education and/or early career. It is incredibly challenging to have children during graduate school. Ilma (F, 40, Pakistan) was halfway through her undergraduate degree program when her mother was diagnosed with cancer. To ensure her eldest daughter was settled before she died, she arranged a marriage for Ilma. Her marriage contract included a clause that stipulated that Ilma, who had big dreams for her career in
engineering, should not be restricted from pursuing her education; however, having children right away was unavoidable. While attending graduate school on a prestigious scholarship in the United Kingdom, Ilma and her husband struggled to support themselves and their two children. Her husband took a part time job in retail while Ilma worked demanding hours at the lab, running between campus and daycare, upsetting her lab supervisor and her babysitter simultaneously. The balance became untenable, which forced the young couple to make difficult decisions. Facing the burdens of high rent and expenses and limited ability to earn money in the U.K., they decided to send their children to live with Ilma’s parents in Pakistan. “It was a big mistake, I should not have done that,” Ilma says in retrospect.

Even if women are able to postpone having children right away, the mere perception of divided loyalties can delay their careers. Employers in India and China are wary of hiring female engineers since they are presumed to drop out of the workforce when they have children (Varma 2017; Dutta 2016; Chen 2012). In China, women are perceived as less reliable and less efficient due to their presumed prioritization of their families over work (Chen 2012:7-8). Employers are also sometimes reluctant to pay for maternity leave and childcare costs for female employees (Chen 2012:8). In India, there is an informal five-year benchmark during which employers ascertain whether women are fully committed to their careers (Radhakrishnan 2011:152). Prior to five years, women are considered risky investments and thus, have difficulty finding jobs and receiving promotions. Indeed, significant gender disparities are seen in the Indian engineering workforce, with women occupying only 6.1% of industry jobs (Parikh and Sukhatme 2004). Among both Indian and Chinese engineers, I heard a common refrain: “Women have to be very exceptional”. Wangshu struggled with these additional constraints during her job search after graduate school. Her husband obtained a position right away in a semiconductor manufacturing
company while Wangshu was turned down for every job she applied for. In the end, she was able to find a job by drawing upon the connections her husband had forged within the company.

**Suitable Careers for Women.**

In addition to pressures of family, women from different cultural backgrounds grapple with diverging understandings of what types of work are appropriate for women. The United States has long struggled with the recruitment and retention of women and minorities in STEM fields, which is predicated upon stereotypes of antisocial engineers and presumptions that women are more interested in social activities and are not good with technology. However, such assumptions are not universal. Although there are discrepancies between men’s and women’s achievements in engineering in South and East Asia, it is not necessarily the case that this is due to women’s presumed lack of technical skill. Nor does the caricature of “nerdy” engineers hold across cultural boundaries. Rather, understandings of appropriate and inappropriate work for women are drawn along culturally specific boundaries.

In India, rather than engineers being perceived as nerdy computer geeks, the occupation is seen as a practical avenue for male providers. In contrast to their American counterparts who choose engineering due to a passion for science and technology, Indian men are “pushed” into the career because it helps them fulfill their expected family role as breadwinners (Varma 2017:40). Raman (M, 35, India) tells me he had three career choices: a doctor, a lawyer or an engineer. He wasn’t a very studious person at the time, so he chose engineering because it took the least amount of coursework. In contrast, women do not typically experience this social “push” into engineering; instead, commerce, social studies and the arts are fields that are perceived as good careers for women (Varma 2017:38). If girls are interested in science, they tend to be routed toward pure sciences, such as physics and biology, or into medicine, which
draws upon associations of women as caregivers. India offers three scientific undergraduate
degree programs: Bachelor of Science, Bachelor of Engineering and Bachelor of Technology. In
2015-16, women made up 48% of B.S. degree programs, and only 28.5% in B.E. and 26.1% in
B.T. programs (Department of Higher Education 2018). These statistics are slightly better than
American institutions, where the 2013 average of biology, physics and mathematics students was
46.6% women, and engineering disciplines have hovered at around 20% women since 1997
(NSB 2016). However, the discrepancies in enrollments indicate a preference among Indian
women to choose the pure sciences, while engineering remains male dominated. Varma (2017)
emphasizes that in India this is not due to the geek/hacker identity that is so common in the U.S.;
the stereotype of antisocial engineers does not resonate in India. Instead, the discrepancy is
almost entirely due to men’s expected role as breadwinners. Asha (F, 32, India) chose physics
because she had more of a passion for it and was not constrained by the expectation that she
would need to get a job, although she did decide to pursue a career. She explains, “Girls get
engineering degrees I think because it’s good on their matrimonial profile? - (laughs) - After
getting married you don’t have to work, it doesn’t matter, but it looks good on your resume. But
[for boys], engineering can get you a job.” In Kalpana’s (F, 30, India) case, she had also
originally been more interested in physics and had little interest in computer science or coding.
However, her early insistence that she wanted to have a career persuaded her that engineering
was a better choice.

In China, women’s “suitable” majors include literature, history and the humanities
(Duoduo 2018). Women may also be channeled into careers that draw on caregiving skills, such
as teachers. Furthermore, engineering degrees can sometimes be a deterrent for women in China,
since some believe that women engineers will have difficulty finding husbands (Dutta 2017:344–
Although good statistics for nationwide engineering enrollments are difficult to find and not always broken out by gender, a 2018 study found that women in Beijing universities make up only 19.3% of engineering majors, which is a slightly lower percentage than both India and the U.S. (Duoduo 2018). Another, in 2015, shows only 6% of women report that they are preparing for a science or engineering career - about half the rate of men (12%) (SWE 2018a).

Furthermore, women who choose engineering tend to be from rural areas seeking “practical” careers, while women from upper-middle class and city backgrounds tend to be drawn toward careers in the arts and humanities (Duoduo 2018). This appears to be the opposite pattern than is found in India, where women who choose engineering are more likely to be from urban, middle class backgrounds (Radhakrishnan 2011). Chinese guanxi networks, important for facilitating education and work abroad, are also considerably androcentric, with women gaining access through their male mentors and professors or other personal connections; only 15% of these networks are exclusively for women (Gu 2016:187).

Although women’s inequalities in the workplace have roots in the patrifocal institutions of nation, culture and family, they tend to be couched in terms of women’s “preferences”. Several of Wangshu’s classmates graduated with degrees in materials science and then became teachers rather than scientists. She indicates this was due to their preference to pursue careers in teaching. This is echoed in other women’s comments about why there are so few women engineering, which are discussed in recognizably gendered terms. “I think women prefer to do indoor work,” Yu Yan (F, 41, China) tells me. Such assumptions rest on gender ideologies that are culturally inscribed, leading women to choose work that is more closely related to care and family, rather than technology and national progress. Radhakrishnan writes that the language of
preference “cloaks a glass ceiling in the garb of ‘choice’” to the extent that “women themselves are fairly convinced that the odds are not stacked against them” (2011:155).

**Concerns for Women’s Safety.**

Another significant factor in women’s unequal representation in engineering careers are centered around perceptions of women’s safety. In many places, it is perceived to be unsafe for women to be out alone, especially at night. In metropolitan India, where ongoing concerns about sexual harassment and assault of women in public spaces make international headlines, it is common for families to place curfews on their college-aged daughters as a safety measure. These curfews are accompanied by restrictions on when and where they are allowed to socialize with boys. Some girls are forbidden to spend time in boys’ hostels, common sites for group studying and networking in engineering classes (Varma 2017:44). These fears are not entirely unfounded, as girls frequently complain about boys “teasing” them at school, which is a code word for unwelcome attention and harassment (Varma 2017:45). Durriya (F, 29, India) confessed that boys had a way of “staring” at girls that made her very uncomfortable and some young men would linger at her desk to flirt with her while she was trying to get her work done.

Although Kalpana’s family did not set a curfew for her, she notes that the practice is widespread enough to be a significant barrier to women’s ability to participate in activities on campus. Her husband, Chetan, has come up against this issue while organizing a Hack-a-Thon at a university in Mumbai. Hack-a-thons are coding competitions in which students are “locked in” at the university overnight. In the United States, such events have been crucial for establishing one’s identity as a “real” coder (Ensmenger 2015). To Kalpana and Chetan’s dismay, the university prohibited girls from participating in this event due to concerns about their safety at an overnight event. Chetan is pushing the school’s administrators to allow girls to attend. “Do you
not trust your students?” he asks. “If you don’t trust them at night you shouldn’t trust them in the
day either.”

Concerns for women’s safety continue beyond universities into the workplace, where
women are carefully shepherded away from positions involving night work. It is a standard
expectation for engineers who work close to manufacturing processes to be available on call in
the middle of the night to troubleshoot interruptions and emergencies. This was a disappointment
for Naomi, who was hoping to get a manufacturing job. However, her bosses were uneasy at the
idea of a woman traveling to a manufacturing plant in the middle of the night. The fact that many
plants in Bangladesh are in remote, rural areas generates additional concern for women without
family in the area. While in the U.S. such concerns for women’s safety are less pronounced, in
practice, women tend to be “protected” from the late shift. Katherine (F, 27, White American)
was hired at a semiconductor manufacturing company after her graduation from college where
there were three open positions: two night shift and one day shift. Her two male coworkers were
assigned to the night shift positions, and she was given the day shift. She felt lucky to have
avoided second shift: it typically involves routine work with less visibility and prestige and it is
hard to adjust to being awake at night and asleep during the day. However, she still wonders
whether she was given that position simply because she was a woman and the manager had
reservations about her safety in the parking lot at night.

In addition to concerns over women’s safety after dark, there are also concerns with
women’s physical safety on the job. As described in the opening, Naomi chafed at the
paternalistic guardrails in Bangladesh that “channeled” her into engineering positions that were
mostly desk roles. It was not considered safe for her to work on the shop floor with heavy
machinery in the garment industry. Women who were interested in manufacturing processes, as
Naomi was, were gently steered into positions behind plastic barriers and computer screens. This is similarly reflected in the discrepancies between women’s enrollments in various engineering disciplines in India: women are close to 50% representation in Electronics, IT, and Computer Engineering, all associated with office work, while disciplines like Mechanical, Electrical, and Aerospace Engineering remain firmly male-dominated (SWE 2018b). Dutta (2017:353) argues this is due to associations between these fields and dirty work, hard work, and involving heavy machinery. Therefore, while the hacker identity may not hold overseas, links between masculinity, dirty work and heavy machinery persist. This is a “push” factor for women toward work in semiconductors; while there are some manufacturing floors with heavy machinery in semiconductor manufacturing, these operations take place in a clean room, where robots do most of the heavy lifting. In addition, there are plenty of office jobs, where engineers perform calculations and design parameters for semiconductor products without the need to travel to the shop floor. Associations between safety and women’s work in engineering resonate with forms of feminization in “pink collar” Caribbean call centers, wherein the drudgery of data entry and customer service are glamorized through professional dress, cleanliness, modern office spaces and technology (Freeman 2000). Although engineering has not yet experienced a formal split between “feminized”, “pink collar” office work and “blue collar” manufacturing work, semiconductors is nonetheless considered “safer” for women than “dirtier” fields like mechanical or civil engineering.

However, concerns for women’s safety combined with expectations of their roles in the family restrict women’s ambitions to seek education and careers overseas, preventing many women from accessing the global semiconductor network. Women are frequently encouraged to stay close to home and family and not migrate too far for work (Varma 2017:41). Perhaps partly
due to these restrictions, professional women are less likely to travel abroad alone and more likely to pursue their educational and career ambitions with their spouses. One study estimates that as many as 69-77% of women doctors, scientists and engineers travel to the U.S. on spousal sponsorship rather than on employer-sponsored visas (Bagchi 2001). Wangshu first arrived to the U.S. as a dependent on her husband’s visa, later getting a job at the same company and switching to her own employer-sponsored H-1B. Although Kalpana had her own student visa, she traveled with her then-fiancé, Chetan, which allayed some of her family’s concerns about her studying abroad.

**Cultural Perceptions of Masculinity & Femininity.**

The United States holds itself to high standards as it promotes its core values of liberty and justice on the world stage. Although in practice, the nation’s efforts often fall short of its own ideals, the U.S. positions itself as a leader in women’s rights around the world. American women are perceived as having a great deal of individual freedom - to choose their own marriage partners, to freely express their sexuality, to choose when to have children, to refuse to have children at all, to prioritize their careers over their families. Given the idealized form of the American career woman, it can come as a shock to migrant women how deeply entrenched gender biases are in the U.S. Dutta’s study of international students in the U.S. finds that “the perceptions women had brought with them regarding the U.S. being a more gender-friendly space were often shattered in the first few days” (2016:186).

Their confusion is understandable. Throughout American feminist history, women have fought for equal rights with men in voting, education, and careers. American women have directly challenged women’s roles in the family, and although these barriers persist, there are encouraging indicators that men are beginning to share more of the housework (Holth and
Mellström 2011). However, structural barriers to women’s equality in the work place persist through the existence of strong gender binaries, which Bourdieu argues rely as much on the symbolic as the material realm (Bourdieu 2001). In the U.S., gender has become a system that is managed primarily via deeply held symbolic binaries, expressed through personality traits and behaviors that are deemed “masculine” or “feminine”. Career choices, along with hobbies, sports, and toys, are coded masculine and feminine. The activities men and women choose reflect upon their gender expression, as do the clothes they wear and the personality traits they develop. Despite their trailblazing feminist heroes, American women are still generally expected to be submissive, docile and caring – and to choose careers to match. Under the guise of personal preferences, women’s frequent decisions (or obligations) to prioritize family and choose careers involving care- and emotion-work appear natural, permanent and unchanging. However, there is nothing “natural” about the boundaries between masculinity and femininity, as becomes clear when perceived through the eyes of immigrant women in engineering who are unfamiliar with the mappings of gender in the U.S.

Immigrant women note with surprise the stark differences between “boys” and “girls” activities in the U.S. Many are disturbed by the pink and blue color-coding of girls and boys clothing and toys. “In the U.S. boys are terrified of the color pink!” Asha (F, 32, India) exclaims, bewildered to discover this phenomenon at her daughter’s daycare. “To be brutally honest,” Durriya (F, 29, India) tells me, “I was really offended by the difference between Boy Scouts and Girl Scouts. I heard that Girl Scouts just make cookies! Making cookies is boring.” Play activities for younger children are not quite as gendered in India. While Durriya had a Barbie, she also had Legos and planes and cars. When she was young, she was captivated by the space shuttle launches she would see on the news. This is not to say that boys do not receive some
early advantages over girls in science in India. Due to the perception that computers may be a promising career for their sons, parents give boys computers as gifts, whether they are interested in them or not (Varma 2017:40). Asha says her parents got a computer for her brother, but not for her; however, this was not so much due to the perception that computers are “for boys” but because computers are “for careers”, which girls are less expected to pursue.

The widespread belief in the U.S. that girls are not as good at math and science is a puzzling discovery for Indian women. In India, girls are regularly “toppers” in math and science in school, quickly dispelling any beliefs that their performance will be substandard. Although men tend to dominate the technical workforce, this is because of their role as family providers, and women’s corresponding duty to take care of the household – it is not viewed as a reflection of women’s mathematical / scientific capabilities. While some accounts from China indicate that women are perceived as not as good at science and technology (Chen 2012:7), Shuang (F, 31, China) tells me that it is not as pronounced as in the U.S. Although there are gender disparities in Chinese engineering careers, as previously discussed, like in India, these are related to women’s position in the family rather than being perceived as inherent abilities.

Newcomers to American engineering groups find it surprising to be one of only a few women in their work groups or graduate school classes. They are also perplexed by the gender dynamics of those teams, in which men dominate the decision-making and leave women out of critical technical tasks (Dutta 2016:184-5). Durriya (F, 29, India) was surprised to find that the male members of her lab avoided her. “It’s like they were afraid of me!” she exclaimed. “They were so shy around me!” While they eventually warmed to her, she felt she had to earn their approval. Studies of women in Indian institutions have found that the “chilly climate” so prevalent in American science is not a common complaint in Indian contexts (Parikh and
Sukhatme 2004). Indeed, women in India report feeling as confident and included as their male peers in their undergraduate degree programs.

Furthermore, intersections between immigrant women’s gender and ethnic identities contribute to misunderstandings about the identities they intend to perform. Chinese women struggle in the U.S. with presumptions that they will always be docile and obedient (Gu 2016:125). Chinese women are exoticized in the West as extremely feminine, contributing to their frequent portrayal as passive victims. Many independent, intelligent Chinese immigrants in the semiconductor industry resent this categorization, as they worked and fought very hard for a place in this competitive industry. Wangshu, whose dress and demeanor are very feminine and happily conforms to her role in the family, has a rebellious spirit and resents being seen solely as a woman. “Take the gender out of it,” she says. “I want to be seen as an engineer who does a good job.”

Women who migrate to the U.S. for work find themselves trying to reconcile gender at work according to cultural interpretation of gender binaries they may not be familiar with. The additional work of performing a coherent gender identity, while simultaneously facing judgment and discrimination from classmates, coworkers, professors and managers, is a more subtle form of patrifocal power that while less visible, is no less effective in shaping women’s career paths.

Conclusion
Reflecting upon the career paths of the women in this study, the question of success for each of these women is not due to their willpower or determination. To be sure, women who enter the prestigious field of semiconductor engineering lack neither. From Naomi overcoming the odds to come to the U.S. for a graduate degree, to Ilma, who struggled to balance raising her two children with earning her PhD. For Kalpana, Asha, and Durriya making their decisions to have a
career rather than stay at home. For Wangshu, Shuang and Lifen, finding their voices as they established themselves independent women working abroad. The women in this study have demonstrated an indomitable will in navigating their careers. What is striking, rather, are the forces that channel their male peers toward the field, while channeling women toward other pathways. Governments and markets set priorities that create demands for particular forms of labor, such as semiconductor engineering. But the conditions and opportunities are structured so that only men’s labor flows in its direction. Women’s labor, instead, is channeled primarily toward careers that are perceived to be compatible with home and family. These flows vary based on country of origin, race / ethnicity, and religion, but the result is somehow the same — men become semiconductor engineers at much higher rates than women. The women who emerge into this field are exceptional, this is true. But it is also undoubtedly true that many exceptional women were filtered out through the numerous structural hurdles along the way.

This phenomena is what Bourdieu has termed “the labor of eternalization” (2001:vii): the work that continues to produce engineering as a male-dominated field, aligning gender ideologies with structural boundaries. The ideology itself is unimportant. Gender ideologies exist in every culture, and varies between cultures, whether it be ideas that manufacturing is unsafe for women, or that women prefer to work indoors, or that women should stay at home and care for the family. Gender ideologies can also change rapidly over time. Expectations over the past century have shifted to encourage women to work full time and find joy in pursuing a career – a scenario that American middle class white neighborhoods would have found shocking in the 1950s. But the relative position of men over women in engineering careers remains unchanged, due to the structural forces that continue to privilege men, while ignoring or inhibiting women who travel the same paths. Women in semiconductors succeed, albeit at lower rates, by
swimming against the tide, rebuffing their expected gender roles, refusing to be channeled. After completing their educations, they arrive in their desired careers only to find that the workplace is no better. They simply exchange the gendered expectations of their nations, families and educational institutions for the gendered expectations of the male-dominated workplace. The androcentric design of the semiconductor workforce and its incompatibilities with the lives of women is the subject of the next chapter.
CHAPTER II
Geographic Flexibility on the Integrated Circuit

Early in my fieldwork, I received multiple “crash course” explanations of the semiconductor industry from my participants, who excitedly described their role in the multi-step process of manufacturing semiconductor chips. Seated at Lucas (M, 35, France) and Anna’s (F, 32, Bulgaria) kitchen table, I noticed a display case that prominently featured several thin silver discs encased in plastic. Anna noticed my gaze and brought one over for me to inspect more closely. This circular silicon wafer was 300mm (about 14 inches) in diameter and no more than 1/8” thick. One side - the silicon side - was solid black; the other side was silver and marked with thin red grid lines. Anna began to describe how impossibly small the components are - thousands of tiny 14nm electronic circuits, visible only under a microscope, can be arranged to fit on a space the size of the head of a pin or the width of a human hair. During the manufacturing process, over a million tiny components are arranged in particular configurations on the 14-inch wafer and connected to each other with double-stranded wires to produce specific electronic functions. Lucas’s specialization at the company was figuring out how to fit all these circuits on the wafer with the most efficient use of space. Once the wafers are manufactured, they are cut into smaller pieces, called “chips”, and packaged to send to the customer. This was Anna’s role. She mimed gift wrapping each chip, stacking multiple chips on top of each other, wiring the connections between them, protecting them with a plastic outer layer. Watching her hands move, I understood that the metaphor of gift wrapping was only a heuristic. Packaging, like most steps in the manufacturing process, is performed by robotic tools. The chips are far too fragile to be touched by human hands. Moisture will ruin them. A strand of hair dropping on the wafer will damage and scatter the circuits. Breathing on the surface will deposit foreign particles and
moisture. The entire process happens in a highly controlled clean room environment with automated machines conducting most of the work. Quality checks occur between each step to ascertain how many chips have been damaged at each checkpoint. It is truly remarkable that a product this finicky can be produced reliably and in high volume.

Despite their enthusiasm for their work, Lucas and Anna’s mood darkened as they discussed their recent misfortune. Both had recently been laid off and were scrambling to find new positions. This had been more difficult for them because they are immigrant employees, originally from Europe, and had not yet had time to build up a solid American career network. While they had both originally been enchanted by the prospect of working on leading edge technology and traveling the world, their careers have been less stable than they hoped. They now wonder if they have made the right decision for their lives.

Lucas was born in France and pursued his degree in nanotechnology. Although his PhD was granted by a French university, his program included an internship in the U.S., giving him an early glimpse into the international mobility this career promised. After graduation, his first job was in South Korea. While he initially felt this was an exciting opportunity to see the world, he found it difficult to learn the language and could not shake the feeling of being an outsider as a European in East Asia. After just six months, he relocated to another semiconductor company in Germany. While working in Germany, he met his future wife, Anna. Anna, for her part, had begun her career as a chemist in Bulgaria and attended graduate school at a prestigious technical institute in Belgium before being hired at the same German multinational company as Lucas.

Shortly after they were hired, rumors about a layoff began to circulate. The company was switching directions from pursuing “leading edge” research & development (R&D) to routine manufacturing only. The technology Lucas had been working on was being transferred to a
branch in the U.S. The company offered incentive packages for volunteers to either relocate overseas or accept plush severance packages and leave the company. As immigrant employees, Lucas and Anna could not legally stay in Germany without another job offer, so they both volunteered to relocate to the American branch.

Unfortunately, a few years later, the American branch experienced a similar shift away from R&D and this time, rather than a comfortable inter-company transfer, they were both laid off. With their visa clocks ticking, Anna and Lucas scrambled to apply to the few competing semiconductor manufacturers in the U.S. The couple’s degree of specialization made it difficult for them to be employed outside of the semiconductor industry. As such, they could not rely on staying in the Northeastern U.S. but were preparing to relocate to the handful of other companies in Texas, New Mexico, California, Oregon or Washington. Anna’s area of specialization, the packaging process, was exceptionally rare in the U.S. since most companies outsource packaging to Asia. Given Lucas’s difficult experience in East Asia, they ruled out Taiwan and Singapore, but held out hope that a European company in France or Germany might hire them as a last resort.

After spending several months in a protracted state of uncertainty, Lucas finally landed a job in Oregon with a competitor who had continued to finance R&D in his area of specialization. In retrospect, Lucas and Anna wonder whether it was wise to volunteer to relocate from Europe. While the opportunity to develop cutting edge technology in a new location abroad had seemed exciting at the time, they now feel unsettled and even betrayed by their former company. However, they reason, there did not seem to be much choice. Even now, they look at their former branch in Germany, which has downsized to a minimal number of engineers on staff, and speculate that they probably would have been laid off if they had stayed. While they had
originally been excited at the prospect of working abroad in so many locations around the world, they had not realized how precarious it could be.

Geographic flexibility is a requirement for employment in the semiconductor manufacturing field. Due to the widespread nature of the semiconductor labor market, the heavy competition between companies (and between nation states), and the rapid pace of technological development, workers are frequently shuffled around to new locations in response to economic demands. Semiconductor companies exist in a rapidly evolving field which requires companies and employees to deftly switch direction as technology improves. The cost to manufacture standard chip sizes, currently 28nm and 14nm, is relatively cheap and profitable. For these standard sizes, the pace of new development has slowed, the tools can be run by technicians, and engineers are no longer needed in most phases of the process. However, as technology develops, chips grow ever smaller, rendering larger chip sizes – and the factories that manufacture them - obsolete. Therefore, it is necessary for companies in semiconductor manufacturing to keep an eye on future technology development to stay competitive.

At the time of my fieldwork, 7nm chips were considered state of the art. Colloquially known as the “leading edge”, or sometimes the “bleeding edge”, a handful of semiconductor companies raced to perfect 7nm technology to be first to market. Although some smaller scale research units were beginning to pursue 4nm and 3nm technologies, these were not yet perceived to be viable for mass production at the time. R&D costs to develop bleeding edge technologies is expensive and takes years to perfect. They require high-quality clean rooms and state-of-the-art tools to protect wafers from damage, along with engineering specialists who understand the complexities of the manufacturing process. While expensive and risky, holding patents to new technology is a long-term payoff that some companies are willing to risk.
Frequently, shifting strategic goals and investment priorities may cause company leadership to reconsider investment in R&D before a finished product is achieved. Like Lucas’s company in Germany, it is not uncommon for companies to invest several years developing a new technology only to transfer R&D efforts to a new location within their own multinational network or to sell the technology to another company to pick up where they left off. Layoffs often follow to downsize the engineering departments that have been relocated. When this happens, engineers who had been involved in R&D must decide whether to follow the technology to its new location, or to stay and find a new role within the company. While choosing to relocate is disruptive, choosing to stay often means shifting to less exciting technology and risking future downsizing as engineers are gradually no longer needed for daily operations. This creates a dynamic in which highly specialized engineers chase the “bleeding edge” around the world, borne by market winds.

The global semiconductor industry exemplifies the ongoing and accelerating pace of flexibilization under neoliberal economic policies, which scholars have long critiqued. David Harvey’s theory of “flexible accumulation” warned that despite promises of greater financial stability with globalization, the practice of outsourcing various pieces of the manufacturing process to disparate regions around the world creates disruptions in social coherence through the destruction of social networks and safety nets (2006:25–26). As the corporation becomes geographically flexible, the burden of adaptation is thrust upon individuals who have little capacity for agency in their roles as employees. Emily Martin, one of the earliest writers on the appearance and proliferation of the term “flexibility” in popular discourse, observes that while it has become highly desirable to be more “flexible”, this flexible state requires learning to tolerate a high level of personal risk (Martin 1994:224), a contradiction that remains unresolved and has
been pushed to greater extremes since the publishing of her work. Illustrating the narrative of flexibility in the context of layoffs, Martin writes, “The powerful system flexibly contracts. The powerless employee flexibly complies. Laid off workers are often enjoined to ‘stay flexible’ if they want to regain employment” (Martin 1994:145). American companies exemplify this trend toward flexibility with their high tolerance for economic change and “creative destruction”, and their willingness to accept downsizing, privatization and dissolution of welfare policies (Ong 1999:211).

Technology companies are frequently at the forefront of flexibilization, pushing the boundaries of labor efficiencies. The production of the Apple iPhone relies not only upon the formal labor structure within the company, but also upon an informal sector of unpaid consumers who provide early feedback on newly-released devices (playing upon the notion of “labor”, this voluntary workforce is termed “play-bor”) (Qiu, Gregg, and Crawford 2014). Although the exploitation of blue collar workers and routinized computer laborers (“gray collar”) is frequently highlighted as a matter of growing concern (Irani 2015b; Gray and Suri 2019), white collar workers at Apple also find themselves in precarious arrangements involving increased risk, stress, and social isolation (Qiu, Gregg, and Crawford 2014:571). High tech workers are often embedded in what Hyde (2015) has called “high velocity” labor markets, in which job-hopping is a requirement for most employees. Rather than settling into a single, stable position over a life-long career, employees are launched into a volatile labor market that requires tolerance of instability and the maintenance of extensive social networks across companies in order to remain employed and climb the management ladder (Shih 2006:182). Although manufacturing is typically thought of as “old” technology, in which employees might benefit from generalist knowledge that applies to multiple industries, semiconductor manufacturing is highly specialized
and growing more and more complex, requiring high levels of expertise (Lin 2016). Unlike Shih’s Silicon Valley high tech workers, employees in the semiconductor industry cannot simply “hop” to other companies in the region, but are often required to relocate across the country, or even between nations, to find work in their area of expertise.

While most critiques of neoliberalism recognize flexibilization as a product of both the nation-state’s economic policy and corporate power, feminist anthropologists locate the capacity for flexibility – or its lack – at the heart of kinship systems and gender roles. As early as 1975, Rubin called for a more holistic accounting of political and economic systems, noting that sex/gender and marriage systems inform and organize divisions of labor and social roles in societies (Rubin 1975:209). Referring to migrant labor specifically, Ong argues that family regimes are more influential on individual behavior amongst migrant workers than either economic or political regimes, regulating the behavior of sons and daughters, husbands and wives, as per their familial roles (Ong 1999:119). Although skilled migrant men may appear to be extractable from kinship systems, “as if they are non-gendered beings who do not form part of a household” (Yeoh and Willis 2005:212), in reality, this is only the case because the family shifts to accommodate his absence due to his accepted role as provider for the family.

Migrant women are tapped for different types of labor than men. Hondagneu-Sotelo (1999) reminds that labor demands are both gendered and racialized and do not remain static over time. Economic pulls for “men’s labor” and “women’s labor” rise and fall with the market and decisions about who will migrate at what time are decided at the level of the family/household (Mahler and Pessar 2006). Although women have typically been employed in carework and domestic labor abroad, women are also tapped for manufacturing, relocating to major cities to work in garment factories (Ong 1987; Lynch 2007) where gendered notions of
their “fast fingers” and careful attention drive preferences for female employees, in contrast to men’s presumed clumsy carelessness. In semiconductor manufacturing, women have historically been employed in outsourced manufacturing centers which targeted Asian women for low-skilled labor in Korea, Hong Kong, Taiwan, Malaysia, and Singapore. Briefly, from 1969-1975, semiconductor manufacturing employed Native American women in the American Southwest until these jobs were outsourced to Asia (Nakamura 2014; Grossman 1980). Only in the past few decades have women begun to make strides in the high-skilled engineering roles typically held by men.

My research makes clear that migrant women of all nationalities often face additional barriers since their family roles do not allow them to be as easily extractable as their husbands. The structures of kinship shift less to accommodate their paid labor and women remain responsible for the majority of household tasks and childcare. Migrant women also lose access to their extended family support networks, who in many cases they would have relied upon for help raising young children (Gabaccia 1992). Furthermore, outdated labor regimes which only account for a single working parent continue to strain families. Berlant has pointed to the emergence of a “global precariat” amongst the professional classes in this new globalized world (2011:192). In response to these new precarious labor conditions, families must “flex”, or make themselves flexible, both structurally and ideologically, to redefine what it means to be a family on the integrated circuit. Even as women are making strides to be included in male-dominated fields of engineering, at the edges of innovation, they are also absorbing the uncertainty of the labor market in order to produce a sense of stability for their families.

In this chapter, I focus upon the ways in which family roles shift to accommodate careers in a field that requires a high level of geographic flexibility. Particular sticking points include
balancing the careers of two educated spouses and the dilemmas of relocating with children. In some cases, the conflicts between work and family life are so great that women choose to take a “career gap”, leaving the workforce for a few years with the intent to return at a later point. However, it is extremely difficult to return from a career gap in a field that is on the leading edge of innovation in a high velocity global market. I build on the work of scholars who argue that kinship is a central node that structures careers, showing how the entire family “flexes” in response to employment conditions. Although men do make sacrifices for their wives’ careers, more often than not, it is women who are responsible for keeping their families flexible enough to respond to the demands of global employment.

Flexible Families

Like Lucas and Anna, Carmen’s (F, 37, Puerto Rico) career has also been profoundly impacted by shifts in the semiconductor market. Her story, however, also highlights the intersections between economic and family concerns. During graduate school, she had internships with two American semiconductor companies but the 2001 Dotcom market crash destroyed her job prospects upon graduation. Her husband, Matt, finally got an offer in Texas, but Carmen could not find employment there. With her partner settling into his full-time job, Carmen worked part time at Best Buy while continuing to send out resumes for a position in her field. Six months later, Carmen received a job offer two states away in New Mexico. Taking a risk, Carmen conditioned her acceptance upon the company finding a job for her partner as well. It worked - Matt was offered a job and the couple moved to New Mexico. All went well until five years later when the company started ramping down its investment in new technology. Gradually, the company began downsizing its engineering workforce. Voluntary retirements and separation packages were offered, but Carmen and Matt decided not to take these offers. Instead,
seeing the writing on the wall, they quietly began sending out their resumes. Family was a major concern at the time. Matt’s mother was ill, suffering from acute kidney failure. Since the company was downsizing anyway, the couple decided it would be a good opportunity to move to the northeast to be closer to her. When an offer came in New York, they jumped at it. They worked continuously for several years, balancing multiple family health scares and doing their best to move up in the company. However, four years later, the process repeated: the company scaled back riskier technologies and downsized the divisions of engineers associated with them. With their families back in good health, Carmen and Matt had already been considering another move back to the southwest. The layoffs provided the push they needed to take the risk and return to their former company, which was now ramping back up its investments in new technology. Carmen is excited to be moving back south, out of the cold winters, but this is also a move that takes them away from their families and the friendships they have made in this area.

In Carmen’s story, we get a glimpse of how the convergence of economic and family concerns result in her decision to relocate to particular regions of the U.S. Although Carmen personally prefers the climate of the southwest, concerns for her husband’s family were central to their decision to move to the East Coast. However, an economic factor provided a critical push. They might not have chosen to take such a risk had the company not been downsizing. A convergence of family and economic concerns constrains their destination as well. They were looking for locations within a certain radius of their families that also hosted companies in the semiconductor network. While other employees laid off in New Mexico would have had a wider range of options in their destination, Carmen and Matt’s options were limited to the East Coast. Furthermore, since the couple are both engineers in the semiconductor industry, they had an additional constraint in needing to find jobs together, which made the search more complicated.
Perhaps the most flexible employees in the industry are unmarried. Studies of career-related migration find that single men and women experience the fewest constraints to their mobility (Abraham, Bähr, and Trappmann 2019; Tharenou 2008). Surprisingly, these studies find that although single men and women are equally willing to move, single women still experience significant constraints due to expected caregiving responsibilities that restrict their ability to follow through (Tharenou 2008). One such example from my research is Emily (F, 34, White American), who changed careers from nuclear engineering to semiconductor manufacturing due to her need to stay close to her family. After getting her PhD, rather than relocating to a nuclear laboratory, where she had established good professional networks and conducted the majority of her dissertation research, she decided to work at a local semiconductor company because it was closer to her father, whose health was poor at the time. Although she had shown significant interest in travel during her research, rotating to laboratories in California, New Mexico and Maryland, when it came to finding a permanent career base, it was more important to her to stay close to her family. In addition to family constraints, some studies also suggest that long distance hiring practices can deter women’s relocation. Gendered assumptions about women’s willingness to move may prohibit companies from hiring women who live far away (Brandén, Bygren, and Gähler 2018). Furthermore, one study suggests that women’s economic incentive to move is lower, since the increase in salary they might earn by relocating is lower than it would be for men (Preston and Grimes 2019). However, on the whole, unmarried employees have much greater freedom to navigate the global semiconductor workforce, with the ability to target companies that are hiring for their area of specialty anywhere in the world. In the aftermath of a major layoff that occurred during my research, younger, single men and women
were envied by many for their relative freedom from family constraints and greater flexibility to adapt to the chaotic job market.

For couples who are married, relocation is easier if only one partner is employed in the formal sector while the other either stays at home or works limited hours. The semiconductor community has a name for this phenomenon: “trailing spouses”. Trailing spouses are usually women, who will take on all domestic affairs and childcare while the working spouse adjusts to his new position. This arrangement is based upon the (male) breadwinner-(female) homemaker model of Fordist capitalist labor is predicated upon, enabling the working spouse to devote himself entirely to paid labor. This is a particularly common arrangement for families who have migrated internationally, since it is difficult for spouses to find employment and obtain their own H-1B visas right away. In this arrangement, the spouse and children, if any, are able to travel along with the working partner on dependent visas (usually the H-4 in the U.S.). However, many trailing spouses are themselves well-educated, with degrees in science or medicine. Some are content with staying at home, immersing themselves in ethnic communities and/or amongst other trailing spouses. However, others prefer to work, and finding a job in the new location is not always easy. In the U.S., the H-4 visa currently allows spouses to apply for their own employment authorization documents (EADs), but the political instability surrounding immigration policies leads to confusion and concern for migrant families. The Trump administration made moves to revoke this policy during his term (Anderson 2020), and although Biden has vowed to stabilize working conditions for immigrant workers, the polarized political system remains unstable. Rumors about the current state of the policy, in addition to the complexity of the visa system, contribute to confusion over who qualifies and for how long the policies will be in place.
In addition, if the spouse’s area of expertise is not semiconductors, he/she faces additional obstacles to obtain employment in a professional field. This results in many trailing spouses who are underemployed. Ameeriar reports that at the time of her research, only 25% of foreign-trained professionals were able to find work in their professions in Canada (2017:6). She attributes this to the difficulty of finding work in the destination country without extensive re-training and re-certification. In addition, racist stereotypes that position migrants as dirty, lazy and uneducated may also contribute to negative perceptions on hiring committees (Ameeriar 2017). As a result, professional migrants are often drawn into either entrepreneurship or feminized positions outside of their professional fields (Ameeriar 2017; Shan, Pullman, and Zhao 2016). I spent time with several families with “trailing spouses” during the course of my research. Ravishankar (M, 44, India) initially traveled to the U.S. on an H-1B visa with his wife to pursue a career in semiconductors. His wife, Chanda (F, 41, India), has a degree in microbiology but she has found it difficult to find work in the U.S. Ravi began his career abroad in Maine, moving to Arizona and later Toronto, before eventually winding up back in the northeast. Throughout these moves, Chanda has focused her energy on raising their two children. However, now that the kids are grown, she would like to go back to work. She is interested in working at a local pharmaceuticals plant, but she has not had much luck getting an interview. Thinking to build her work experience in the U.S., she took a temporary job in public service for a few months, but when that job ended, she had nothing else to fall back on. Another trailing spouse, Mythri (F, 43, Malaysia), has a medical degree in her home country of Malaysia. However, the requirements to practice medicine are much more strict in the U.S. and she has had trouble passing the exams. In addition, she is not sure if she will be able to work even if she does get her license, due to the family’s green card status being in limbo, so it is hard to find the
motivation to study with the level of intensity that is required. She is currently looking for volunteer work in hospitals, to see if she will like it, before making a final decision. For both of these families, the decision to prioritize one spouse’s career as a lead migrant makes migration options simpler; however, this requires the sacrifice of the other highly-educated spouse’s career.

For marriages in which both partners work outside the home, geographic flexibility becomes more complicated, creating what is referred to as “the two-body problem”. In order to avoid the difficulties of a long-distance relationship, when one spouse needs to relocate, the other partner must also find a job in a similar location. Studies have shown that in most cases of couple’s dual relocation, the husband’s career takes priority (Petriglieri and Obodaru 2019; Becker and Moen 1999; Bielby and Bielby 1992). While this effect is reduced in couples who challenge traditional gender norms, as is more common in upper-middle class households like those found in the semiconductor industry, gender disparities in job-seeking practices persist. For example, a recent study shows that it is more common for couples to avoid a relocation that would result in a salary reduction for men while tolerating salary reductions for women (Bielby and Bielby 1992). For couples in which both partners are pursuing professional careers, Petriglieri and Obodaru (2019) propose that couples’ career priorities are determined by their assessment of which partner is perceived as a “secure base”. In a uni-directional secure base model, one partner provides financial and/or personal stability while the other is liberated to pursue more exploratory behavior to pursue their professional goals. In rare cases, couples may have a bi-directional secure base structure, in which partners provide mutual support for professional exploration. However, Becker and Moen (1999) suggest that it is more likely to find one partner “scaling back” to enable the other’s career than a true dual-career partnership. Strategies for “scaling back” include (1) placing limits, in which one partner establishes clear
limits on what they are willing to sacrifice for their career, (2) having a one-job, one-career household, in which one partner is employed in a less demanding position, and (3) trading off, in which partners alternate career moves in an attempt to be more equitable (Becker and Moen 1999).

While there are certainly many couples who follow a normative arrangement in which the husband’s career takes priority, in semiconductor engineering, women leverage their education and passion for their work to force their families to flex to accommodate their careers, with considerable success. For example, Michelle (F, 44, Indonesia) and Daniel (M, 45, Indonesia) have a unidirectional arrangement in which Daniel is the “secure base” and Michelle is free to pursue her career on the global circuit. Daniel works in information technology (IT), a generalist profession that has made him employable wherever he goes. Both born in Indonesia, they met in college in Texas. They were both on track to finish graduate degrees, but their growing student debt placed them on uncertain ground. “She refused to marry me until I had paid off my debt!” Daniel jokes. Daniel stopped after his Master’s degree to take a full time job in IT while Michelle finished her PhD in chemical engineering. A few years later, Michelle got an opportunity to relocate to a semiconductor company in Germany. Excited at the opportunity to live and work in Europe, they jumped at the chance. Daniel called his boss at a multinational software company and said, “I need to move to Germany.” To his surprise, it was easier than he expected. His boss’s attitude was “Whatever it takes to keep you working for me!” They worked out a plan for him to stay in his American work group and work remotely from Germany. He had to forego the standard international package in which the company pays for housing, food, and children’s schools, but they agreed to pay his visa and legal fees. This opportunity paved the way
for Daniel to work entirely from home, even after they returned to the United States. No matter where Michelle finds work, Daniel can follow with relative ease.

This arrangement has enabled Michelle to chase her professional dreams. She has been promoted several times, but more importantly, she has been able to pursue her passion as a researcher in a highly mobile industry. To be sure, Daniel has also had a very successful career. He is currently an executive director at his company, but his role in the family has always been as a stable provider. He was the financial backbone of the family while Michelle pursued her PhD and he has maneuvered his career to fit around hers as she chases leading edge technology across continents. Furthermore, Daniel’s remote work has enabled him to be more involved in raising their daughter. When the couple lived abroad, it was Daniel who flexed his work hours to do drop-offs and pickups from daycare. It is perhaps unsurprising when I ask Michelle what her secret for success has been, she grins and says, “I chose a good husband!” Throughout multiple meetups, Michelle frequently reflected upon the difference it has made in her career progression to have a supportive husband, giving her more freedom to pursue her career goals.

Not everyone is lucky enough to have a spouse who is able to find work anywhere in the world. In the semiconductor industry, it is relatively common for both partners to work in semiconductors. This can be convenient but given the limited number of companies who hire in this specialty area, it requires a shuffle every time one spouse needs to change jobs. In this scenario, it is easiest (and most common) for the other partner to find work in the same company. From the previous chapter, Wangshu (F, 38, China) was able to negotiate a position at a semiconductor company because her husband already worked there. Although she followed her husband, this can also work in the opposite direction with the husband following his wife. This
was the case for Carmen (F, 37, Puerto Rico), who was able to negotiate her husband’s position as a hiring bonus.

“When I got hired [in New Mexico], he was working [in Texas], I brought my husband’s resume over and said, ‘I won’t move to New Mexico if you don’t find him something.’ And it worked out! He got a job! (laughs)…Every single time, when we found a job, we actually brought the other one along. Like ‘I’m not moving without her, and he’s not moving without me.’”

In an attempt to keep their career paths equitable, some couples use a “trading off” strategy (Becker and Moen 1999) in which spouses alternate career moves. Leena (F, 41, India) explains that this has been her and her husband’s process, at least in theory. He would go through a period of intense work while she rested in place, and then she would get her turn once he had settled. That was the idea, anyway. In practice, it has been a little less equitable than she hoped. She has excelled in her career and has been grateful for the support she receives from her husband to pursue management and technical leadership. However, she was dismayed to find, not once but twice in their careers, that her husband had accepted promotions without consulting her. The first time, after her first management offer, she fretted and made pros and cons lists, articulating detailed plans of how they would manage the household with her additional responsibilities. She finally accepted and braced for a period of intense stress as she adjusted to the new job. She was counting on her husband to remain steady to fill in the gaps at home. Six months later, her husband was also offered a surprise promotion. He accepted in thirty minutes without consulting her.

“I was SO upset with him. I’m still upset with him…. He’s like, ‘Yeah, we’ll just do it all. Yeah, the kids won’t have as much attention, maybe that’s okay.’ So his standard for what the kids should get was different than mine.”
In this statement, Leena reveals that she maintains clear limits on how much she was willing to sacrifice in care work for the family to accommodate their careers, a point which she discovered she and her husband had very different opinions.

To her dismay, this was not a standalone incident - this scenario repeated itself when Leena’s husband applied for relocation to Europe without consulting her. She was furious when she found out he had received an offer. The technological innovation was moving, he argued. There had just been a round of layoffs and opportunities for career growth were closing in the Northeast. However, Leena’s career was just taking off. She had been promoted twice in the past two years. Furthermore, she had never worked for another company and didn’t have strong networks outside of it. She considered her options for several months, but eventually decided to take a job at the same institution as her husband in Europe. It was too much to ask the family to do, she reasoned, to have her husband live in Europe while she stayed in the U.S. The tensions underlying Leena’s frustrations reveal gendered ideologies about parenting, in which “good mothers” are expected to prioritize care for their children, whereas “good fathers”, rather than prioritizing care, are expected to provide financially for the family.

For Leena and her husband, while outwardly striving for the third of Becker and Moen’s (2019) strategies for managing dual careers, “trading off”, they are undercut by the second strategy, “placing limits”. Leena has unspoken limitations on how far the family can be flexed that go unrecognized by her husband and unacknowledged in their plan for equal growth. It is revealing, if unsurprising, to find that her husband feels less responsibility for the maintenance and wellbeing of the family. By neglecting to recognize the needs of the family as a whole, by default, he leaves Leena responsible for maintaining a balance between the need to stretch the family to fit their lives on the integrated circuit and the need for the stability of a “normal”
family. Thus, despite couples’ best efforts to seek career growth for both partners equally, women may continue to find themselves responsible for managing this flexibilization, while their husbands are able to focus single-mindedly on their careers.

Finally, for those couples who are unable to move together, the idea of a “normal” family itself must be flexed. It is not uncommon in this discipline to find spouses working separately, from a few hours’ drive to entire continents away. These cases are precarious and not usually viewed as a long-term solution, but a temporary measure until one spouse is able to find a job closer to the other and the family can be reunited. Here again, we find multiple examples of families in which women are repositioned into the “provider” role. When Yu Yan (F, 41, China) was transferred to the U.S. from Singapore, her husband moved with her hoping to also find work in semiconductors. Unfortunately, a job never materialized. Feeling demoralized, he returned to Singapore to work. This arrangement was short-lived. Just one year later, when Yu Yan had her second child, her husband returned to the U.S. and is now a stay-at-home dad. Although the forfeiture of his role as a provider has been difficult, Yu Yan’s career is more stable and it makes the most sense for now.

For Asha (F, 32, India), family roles flipped midway through her career. Her marriage began in a normative gender role arrangement, with her husband as the “lead migrant” and major breadwinner. Asha was a physicist and at the time was not certain she was interested in engineering jobs. However, by the time Asha graduated from her PhD program in Florida, her husband had already relocated to a semiconductor company in the northeast. She wanted to work, but she would need an employer who would sponsor her visa, preferably in the same region as her husband. The path of least resistance in this case was to try to find a job at the same company. Using his employee insider networks, her husband was able to help her apply for an
open position. Although semiconductors was not her area of specialty, she discovered she liked the work and was promoted quickly.

After a few years, their family roles shifted. Asha came to be seen in her relationship as a “secure base” - she earned a good salary and was willing to place limits on her own professional goals to care for their children. “I’m not that ambitious,” she tells me, laughing. She is not keen on becoming a manager or climbing the executive ladder. Her husband, however, had big dreams that extended beyond engineering. He wanted to own his own start-up film company. “In India,” Asha explains, “you become an engineer first and THEN you can be a film star.” With Asha’s steady income and career track established, the family decided they had enough stability for him to pursue his dreams. Asha is now the major financial provider and the primary visa-holder for the family. Her husband is listed as a dependent, and her daughter is an American citizen. To pursue his film career, her husband moved back to India and travels to the U.S. to visit Asha and their daughter several times a year.

This flexible family arrangement has been difficult on everyone. Asha and her daughter have both experienced significant health problems in the past year, which they have had to handle mostly on their own. Asha falls into depression frequently, feeling that her family is torn in two. She and her husband, realizing that this is not a good long-term arrangement, are debating ways to bring the family back together again. For a while, he thought perhaps he could run his business from the U.S. However, that dream collapsed this past winter when they did a test run and found it wasn’t feasible. Now, Asha debates whether she should give up her career to move to India. This would once again require a significant shift in their “secure base” configuration, in which her husband would have to absorb greater financial responsibility. Asha believes she would probably have to become a housewife if she returns, since she doesn’t want
to put in the long hours that Indian companies expect. Another alternative would be for her to
take a support role in her husband’s film business. They have delayed this decision for a year to
deliberate, but Asha knows that eventually either she or her husband will have to make a
sacrifice.

In this case, the “secure base” lens is revealing. From an outsider’s perspective, both Yu
Yan and Asha appear to be prime examples of feminist progress. They both have their own
careers, are the breadwinners for their families and are the primary visa-holders. They are able to
“have it all” - balancing a career and a family. However, where Asha’s case differs from Yu
Yan’s, is that Asha’s husband is the one who is liberated to pursue his dreams. In Yu Yan’s case,
her husband has sacrificed his career to become a “secure base” to keep the family together and
provide additional childcare. For Asha, although she is the major provider, the gender roles are
not reversed. Her career is still secondary in importance to her husband’s, and the family flexes
to accommodate his dreams.

Children create an additional layer of complication to work-related relocation.
Anthropologists have argued that although children have generally been treated as mere
dependents, they exercise considerable agency in their families’ decisions to migrate
(Hondagneu-Sotelo 1999; Orellana et al. 2001). Families with children, especially those in the
eyear of childrearing, are more likely to “scale back” in their careers until their children are
older and more independent (Becker and Moen 1999). However, in the highly mobile industry of
semiconductor manufacturing, while younger children are harder to care for, older children are
harder to relocate. Once children reach middle and high school age, relocation means pulling
them out of familiar schools and settings. National moves are difficult on teenagers since it
means leaving behind all their friends, their teams, their clubs and other important fixtures of
their lives. International moves are even more difficult since this requires adjusting to an entirely new pedagogical philosophy. Parents contemplating a move from the U.S. to Asia worry that their children will not be able to keep up or adapt to the more rigid educational system. For younger children, moving is easier, since children are perceived to be more malleable to their changing circumstances. Parents of high school aged children can be very reluctant to move. This dynamic essentially locks workers in place for four years (per child), unable to respond to the market shifts, which may set them back in their careers.

In order to accommodate dual careers across multiple countries, decisions must be made about how best to care for children. When spouses are separated, the children are more likely to stay with their mother, making her a de facto single working parent. Such decisions rest on presumptions that women are more natural caregivers for children (Rosaldo and Lamphere 1974; Ortner 1972). Mingzhu (f, 30, China) has had a rough year in this regard. Her husband recently relocated to Texas, leaving Mingzhu and their newborn son in New York. For a few months, their parents visited to help out with the new baby, but they had to return to China when their visas expired, leaving Mingzhu alone. She has been miserable, feeling she does nothing but work and take care of her son. Her social life has dwindled to nothing. She wants to go out hiking and other outdoor activities but feels this is impossible with a small child. She is resentful of her husband being so far away, and they argue frequently. She has been trying to look for jobs but can’t find one in Texas. She is considering all the options: getting a nanny, sending her son to live in Texas, even quitting her job. She doesn’t want to quit. She knows the consequences of taking a career break. But she is at the end of her rope and doesn’t know what else to do. Stories like Mingzhu’s demonstrate the vulnerability of women in this hyperflexible discipline. While her husband chases his research career on the integrated circuit, she is obliged to accept the role
of the “stable base” involuntarily, utilizing the discourses of women’s duty to their families and children. Reluctant to relinquish control over raising her son, she worries about whether he will receive enough care if she sends him to live in Houston with his father. She loves her role as a mother, but she feels trapped in her career, unable to advance until she has more support at home.

In very rare circumstances, children may stay with their father. I found only one example of this arrangement. Just before Christmas, Teresa (F, 37, White American) told me she had received a big promotion that required her to transfer to another branch of the company, located a few hours away. She felt this opportunity was too good to turn down, so she accepted and made arrangements to rent an apartment in the new location during the week and come back home on the weekends. She planned to leave her three-year-old daughter with her husband so as not to disrupt her routine. She faced subtle judgmental attitudes from her colleagues about this decision. While many expressed support for her decision, there was an undercurrent of condescension in their questions about the family arrangements she had made. “That’s so great that you are making this brave decision!” she paraphrased their comments. “I don’t know if I could ever do that! (Pause) But it’s great that you are!” Teresa feared that they thought she was abandoning her family or was a bad mother. She also interpreted some self-righteous smugness in her colleagues, as if her decision made them feel superior about their own life choices. At the time, she brushed the comments off, telling herself she was following her own path and that she was excited about the new opportunity. But she couldn’t shake the injustice of it. “They would never say that if I were a man,” she confided to me. The temporary separation of the family did not last long. After only six months, Teresa discovered she was pregnant again and moved back home. It was too difficult to live separately from her family, she told me. Especially with a new
baby on the way, it would be very hard to maintain the travel back and forth and take care of a newborn on her own. She mourns the loss of what she still feels was a great career opportunity but knows that this was best for the family. Such decisions emphasize the importance of family regimes in structuring how, when, and whether migration for work takes place.

In particularly difficult scenarios, families may choose to send their children to live with their grandparents, particularly when they are very young and need a lot of care. In this study, this was observed primarily amongst Asian households, although similar practices have been established amongst Latin American and Filipino migrant families as well (Parrenas 2006; Hondagneu-Sotelo and Avila 2006). Given the heavy demands of a dual-career household, the rationale is that it may be preferable for these so-called “parachute kids” (Ong 1999:128) to be raised under the watchful eyes of their grandparents while their parents struggle to establish their careers. Yu Yan (F, 41, China) chose this option for the year that her husband was working in Singapore. She found it too difficult to be a single parent and work in the demanding semiconductor industry at the same time. This arrangement only lasted for a year, after which the family was reunited in the U.S. with her husband now in the role of stay-at-home-father.

Ilma (F, 40, Pakistan) and her husband also sent their sons to live with their grandparents in Pakistan while she pursued her PhD in Cambridge. The family’s main concern was finances – in order to afford the high cost of living in the UK, she and her husband had to work around the clock to support themselves. Ilma told herself that without two children to care for, she could accelerate her progress in the PhD program and then bring the children back as soon as she could. The decision to part with their children was heart-wrenching for Ilma and her husband. “I cried every day. I had to leave my son over there for two years. That was the hardest part of my birth, I didn’t get to keep my son.” She continues to harbor regret for this temporary separation
and wonders if she could have done more to keep her family together. However, this difficult decision is not uncommon for migrant families, many of whom have periods of time in which it is simply impossible to balance the demands of work and family overseas.

One less frequently discussed phenomenon, particularly in engineering circles, is the career gap. Multiple women in engineering that I spoke with had taken several years off from paid labor until their children were old enough to go to school. This was far more common than I had previously realized, yet it seems to barely register as an option in engineering companies. In a wide range of professions, factors contributing to women’s decisions to take a career gap include their partners’ long work hours and unequal distribution of household labor (Cha 2010; Bröckel 2018). The upper-middle class cultural practices of intensive parenting also contribute to the erosion of women’s work-life balance, leading them to feel they need to take a break to prioritize their children’s development (Cha 2010). Once women leave their professional careers, they are unlikely to return to their previous profession; when they do return to paid labor, they often pursue a female-dominated career that is more accommodating of family life (Lovejoy and Stone 2012). Recently, governments are beginning to recognize the leakages from the STEM workforce due to career gaps and are taking measures to help women re-enter engineering careers after taking time off (Herman and Kirkup 2008; Herman 2015). However, re-entry is very difficult. Ehrenreich writes about the impossibility of career gaps in white collar professions, observing that “a gap of any kind, for any purpose - child raising, caring for an elderly parent, recovering from an illness, or even consulting - is unforgivable” (2006:169). Women returning to a career in engineering face an uphill climb in keeping up-to-date on their skills, convincing companies to re-hire them, and striking a new balance between work and family life.
Vidya (F, 44, Indian American) took time off work to stay home when her sons were young. “If you knew me before kids, you would never have pinned me as someone who would have taken a career break,” she says. “Never.” But it so happened that her contract termination in Belgium coincided with her first pregnancy. Unsure how to navigate changing positions while pregnant, she decided to take a short career gap. She tried several times to come back to work, but the family’s frequent relocation created some additional hurdles.

“Every time we started getting into the regular [routine], we would move. So my second son was born, we moved to New York when he was six weeks old. I don’t know why I moved so close to pregnancies! ((laughs))…Then, when he was turning two, we got an awesome opportunity to do an expat in Germany. We were only supposed to be there for 11 months, so I was like, I’ll have a great time with the kids and then I’ll get a job. Then it became two years.”

In total, Vidya was out of the workforce for seven years. When she did eventually return, the adjustment took over two years. Semiconductor technology changes rapidly and she found herself struggling to catch up to the current state of the field. Looking back, she feels that she missed out on fundamental knowledge about the technology developments over that seven years that she can never catch up on. In addition, she struggled to devote as much time to her kids as she preferred, feeling guilty that she couldn’t spend as much time with them as she had when she was at home. She felt torn between her desire to continue her career and her love of her children. “When I first came back, within two months, I was like, I cannot do this, I cannot re-enter.” She tried to quit, but her boss wouldn’t allow it. “‘One year,’ [my boss said]. ‘Do this for me, do one year and at one year if you’re still feeling the same way, quit.’ So I said, okay I can do that.”

One year came and went, and Vidya continued working. However, two years later, she hit another wall and for the second time, tried to quit.

“I had a serious breakdown. We hadn’t completely adjusted at home. We were in such a habit still, because I went back to work but still retained all of the responsibilities I had
before I went back to work…I went in and attempted to give my resignation to my boss. He was like, ‘Nope. Nope. Nope. Not happening.’”

With her manager’s support, Vidya was able to flex her schedule so that she could find more balance between her work and home life.

As briefly mentioned in the previous chapter, Wangshu (F, 38, China) also became a “trailing spouse” for over two years while her husband worked in Germany. Her re-entry story highlights the psychological barriers women face when returning to work. She had worked in semiconductors in Shanghai for several years until her husband was transferred to a company in Germany. The couple tried to live separately for a few months, but Wangshu had just had her first child and was struggling to work and raise the baby alone. Eventually, the family decided it would be better for her to move to Germany and be a stay-at-home mother. She enjoyed her time at home with her daughter, but she eventually grew bored. “I may not be the kind of person who loves to do housework,” she jokes. However, she experienced significant social anxiety which deterred her from applying for a new job. Her social circle in Germany was limited to a few friends with children around her daughter’s age. The longer she remained in this small social circle, the more she felt her world beginning to tighten around her. “[You are] not only bored, you know, you just become afraid to talk to new friends. Also you are afraid to challenge yourself. It’s hard, it changes you. You want to go out, but you’re afraid.” It was hard for her to force herself to reach out again, but her boredom at home eventually outweighed her anxiety. When her husband transferred to the U.S., she decided to resume her career in engineering. Fortunately, she was able to leverage her husband’s position to land an interview. She received an offer from a manager who has a good track record of accommodating family life. It has been a
struggle to come back, but Wangshu has overcome her social anxiety and carefully managed a balance between her new professional life and her family.

For both Vidya and Wangshu, their family’s relocation was a significant factor in their decisions to take a career gap. The arrival of a new child combined with the need for the family to flexibly adapt to relocation created a conflict that was difficult to resolve in a dual-career household. The path of least resistance in both of these cases was to allow their husbands, unburdened with pregnancy, to become the lead migrant, while the wives took on the role of “secure bases”, temporarily quitting their jobs and staying home with the new baby. For Vidya’s family, their multiple relocations threw up additional barriers to her re-entry. Every time she would feel she was ready to come back to work, they would have to move again. For Wangshu, the family’s second relocation was part of the incentive for her to return, jolting her out of her small social circle and giving her the opportunity to start over in a new place. Still, both women experienced significant struggle to get back up-to-date as a result of their career break.

Given women’s struggle to balance work and family, career gaps are a necessary accommodation for families who may experience a number of challenging life experiences, from early childcare, to elder care, to illness. Although it is not yet widely accepted as a part of a normal career path in the professions, it has the potential to become a standard practice. For Vidya, it has now become a passion for her to help other women re-enter after career breaks in engineering.

“You don’t lose this stuff. It’s there. It’s just a different technology and a different question you’re answering. But it’s the same skill set…Why shouldn’t we accept them back in? It’s a small demographic, but it’s a high value demographic that we should have more formalized programs to address.”

The Silver Lining
Despite its many drawbacks, the flexibilization of work across national boundaries does provide openings for greater equality within family structures. While early projections that women’s employment would automatically improve women’s status in the household have fallen short, Hondagneu-Sotelo reports that in the case of Filipino nurses the acquisition of both legal status and professional status has indeed translated to greater power within the family (Hondagneu-Sotelo 1999:570). When families migrate together, particularly to destinations with more egalitarian gender norms, men begin to contribute more to housework (Mahler and Pessar 2006). Kurien’s (1999) ethnographic fieldwork among Hindu Indian professionals in California similarly reveals that immigration creates conditions under which cultural practices, including gender ideologies, are challenged and reshaped. Since women are the cultural custodians charged with translating culture across national boundaries, they have subtly reformed the patriarchal family structure to better align with Western feminist principles (Kurien 1999:650). As a result, in these families, there is greater egalitarianism in the division of housework between husbands and wives.

In semiconductor manufacturing, women engineers from a variety of national-ethnic backgrounds describe their husbands as supportive of their careers and involved in family life. While the division of labor in the home is not yet entirely egalitarian, they recognize that the effort their husbands put in is greater than would have been expected in the past. Furthermore, relocation to the U.S. has had a positive impact on men’s participation in home life. Omala (F, 33, India) remarks that it is understood that when you move to the U.S., it’s expected that family expectations will shift. In her home country of India, traditional marriages in which women do not work, are still common. However, migrant families recognize that family structures are different in the U.S., where men are expected to contribute to the household labor. Omala
observes that some men adjust to this better than others. “Some men struggle with the shift in roles. They believe they shouldn’t have to do certain kinds of tasks,” she says. But most families will reorient to accommodate the cultural norms of American families.

A few of my male participants found the new paradigm liberating, enabling them to spend more time with their children. When Ravishankar (M, 44, India) first moved to the U.S., he befriended an American doctor who served as an example of the kind of father he would like to be.

“He made hundreds of thousands of dollars. [But] he used to sweep, wash dishes, comb hair! This is awesome! He was down to earth. He was sending a message to his kids. And I was like wow, he is an inspiration to me…I’m like these are good qualities. It will make me a good human being. I had no issues. At home I will do everything!”

In Ravi’s eyes, despite the doctor occupying an upper-class lifestyle, in which it might be possible to hire nannies or housekeepers, the doctor’s commitment to his family was inspirational. Ravi’s household division of labor is not completely equal – his wife is a stay at home parent and retains responsibility for the majority of the household management. However, Ravi does his fair share of cooking and takes pride in being an active father to his two sons. His enthusiasm is common among the immigrant families I spoke with.

Despite this progress, Leena (F, 41, India) points out that household divisions of labor are still unequal and tend to be evaluated in relation to past conditions. “So women learn how to be mothers from watching their mothers. Men learn how to be fathers from watching their fathers. In comparison to their own fathers, men feel like they are doing very well!” Although she agrees that her husband far surpasses his own father’s involvement with the family, she still is primarily responsible for most household operations, serving as a sort of project manager for the household. “I just assign him tasks! The house drops if I’m not there,” she says wryly.
“It’s hard! I pack two snacks per kid and one lunch per kid per day. He likes grapes, she *hates* grapes. She likes apples, but he doesn’t like apples. No peanut butter for him. (Laughs) My husband doesn’t do it. His excuse is it’s too hard. Whenever I have to travel on business, I actually make a chart. By day and by kid for snack and lunch and write down exactly what to pack. I’m not kidding.”

While she doesn’t mind the work, she acknowledges that retaining a detailed knowledge of each child’s likes and dislikes and making the effort to accommodate them is a difficult role that her husband is unwilling to fill. In preparation for a business-related trip, she spends extra time making detailed charts for how to pack each child’s lunch. Her husband, in turn, is able to remain a simple executor of the tasks she assigns, a far less labor-intensive role. A recognition and analysis of the mental labor of running a household is perhaps the next level of progress required within families on the long road to equity at home. Similar to diLeonardo’s (1987) concept of “kin work”, referring to the labor women invest in maintaining kinship networks, women retain the primary responsibility for the planning and operations of the household. However, we can simultaneously recognize the positive impact of migration as an impetus for significant change within the divisions of labor at home. As families shift across national borders, there are encouraging shifts to more egalitarian family arrangements than would previously have been expected.

**Conclusion**

The conditions of labor in this new globalized workforce drive the emergence of a number of new strategies for the flexibilization of families. Although migration is frequently imagined as a decision made by individuals, ethnographers have long argued that such decisions are nearly always made at the family level (Ong 1999; Mahler and Pessar 2006). In semiconductor manufacturing, we find similar dynamics as spouses juggle whose career should
take priority while navigating the global “integrated circuit”. We find many positive developments in this field as women are empowered to pursue their careers in a male-dominated profession, frequently reworking family life to enable their career progress. In a few cases, such as Michelle (F, 44, Indonesia) and Yu Yan (F, 41, China), women’s careers do indeed take priority as their husbands’ careers become a “secure base” from which women are enabled to engage in more exploratory careers, job-hopping between companies and continents. However, more frequently, women retain the “secure base” responsibilities. For Asha (F, 32, India) and Leena (F, 41, India), despite the family’s best intentions of “trading off” and the outward appearance of feminist progress as they move up the corporate ladder, they are disappointed to find that their careers remain secondary in importance to their husbands’.

It might be argued that flexible labor-based migration provides the impetus for families to rework themselves to become more egalitarian in nature, and thus flexibilization could be considered a net positive for women. It is indeed true that for many families on the “integrated circuit”, the divisions of labor between men and women are becoming more equitable. However, it remains the norm that women retain responsibility for maintaining the well-being of families and their careers are the ones that are most often “flexed” in order to provide a sense of stability for the family, a quality that has been argued is a fundamental human need (Martin 1994:249).

During especially challenging times when families are experiencing the converging demands of global flexibilization and the needs of the family, the very definition of family must be flexed. Difficult decisions are made for spouses to temporarily live separately or send children to live with grandparents. Such arrangements challenge concepts of a local “household”, pushing its members to reconstruct notions of family that transcend national boundaries. In some instances, facing the substantial hurdles of both spouses finding jobs together, women choose
instead to take career gaps, flexing their own careers to secure the well-being of the family during times of transition. These career gaps are a substantial interruption that are difficult to return from and often require women to sacrifice their previously held notions of “having it all” in their professional and family lives. Many women do not return from career gaps at all, or when they do, choose to return to a more family-friendly career rather than engineering. We may never know for certain how many women’s careers in engineering were derailed due to an inconveniently timed relocation.

As a result of flexibilization, migrant engineers have found themselves members of what Berlant has called a “global precariat” (Berlant 2011:192), characterized by a life with few of the foundational certainties of location and employment that would have been expected in past generations. Berlant argues that this phenomenon is remarkable for two reasons: (1) this sense of fragility now permeates beyond the poor and working class into the middle and professional classes, and (2) substantial work must now be invested to create the appearance of stability in a fundamentally unstable environment (2011:195). At the level of the family, this work is performed by women. In semiconductor manufacturing, women are not only taking on careers in male-dominated fields and succeeding. They are also absorbing the impact of uncertainty. This labor involves a constant struggle to keep up the appearance of security where the foundations themselves have disappeared. In this chapter, I have outlined the macro-level flexibilization of families as a result of globalization. However, worker protections are also deteriorating at the local level, necessitating flexibilization of the everyday lives of engineers. How these modern work conditions impact the lives of women is the subject of the next chapter.
CHAPTER III
Flexible Mindsets: The Discipline of Everyday Life

Vidya (F, 44, Indian American) is one of the best multitaskers I have ever met. From day to day, week to week, month to month, she lives her life in a constant state of flux, balancing her work schedule, family obligations, her own and her husband’s intermittent international travel, for business and pleasure, and the high standards she holds in every aspect of her life. One morning after a particularly heavy snowstorm, I met Vidya at her home where she was working remotely to avoid the winter weather. Her husband, Mark, had just returned from a trip to Singapore and was still very jet-lagged. He made us both coffee and we all made small talk. I remarked that it sounded really exciting to travel to Asia for work. It sounds much more exciting in theory than in practice, they told me. It is difficult to navigate international airports, especially with the recent winter weather in the mix. Mark’s flight was nearly canceled for snow, causing the whole family to have to rethink their plans for the week if he was not able to come home. In addition, both Mark and Vidya travel regularly and these international trips require significant juggling of schedules. On the rare occasion when Mark and Vidya’s trips coincide, one person will have to reschedule to stay home with the kids. In some ways, the fact that they both work for the same company makes this easier. They are both subject to the same corporate business priorities, so if there is a conflict, their bosses tend to be willing to work it out. But it still requires a lot of effort to manage two busy travel schedules. Once our coffee was made, Mark headed to the living room to lay down. He slept soundly while Vidya told me more about her typical work week.

When they are not traveling, she and Mark get up at 6am and get their two sons ready for school. The school bus leaves at 7am, so they usually arrive at work by 7:30 or 8. Vidya’s
mornings are filled with meetings. Since she has a lot of clients overseas, mornings are a good
time to schedule conference calls. She works straight through lunch without stopping to eat. In
the afternoons, sometimes she can snag an hour or two to work on her high priority projects.
Other days, there are too many demands from her colleagues and the employees she manages, so
her own work gets pushed off. She tries to leave work by 2:30, making every effort to block off
her calendar so she can be home with her kids when they get done at school. She makes them
snacks and eats herself for the first time since breakfast. While the boys do their homework, she
works remotely for a few more hours. She tries to save her easy tasks, like checking email, for
this time period so that if her kids need to interrupt her for homework questions she can stop and
start easily. She works until Mark gets home, usually around 5 or 6pm and they eat dinner as a
family. At 10pm, the kids go to bed and she and Mark might do a little more work to get a jump
start on the next day. Particularly during times when something controversial is going on at
work, it gives Vidya peace of mind to prepare for the issues she will need to address first thing in
the morning. They are in bed by midnight and ready to get up and repeat it all the next day.

Mark and Vidya live their lives on the extreme end of the flexibility spectrum, balancing
international travel and keeping their home lives afloat with regular remote work. For Vidya,
flexible work policies are a lifeline that have enabled her to approach the elusive “work-life
balance”. Like many working mothers, she has faced periods in her life where she considered
quitting her job because balance was too hard to achieve. Flexibility was the tool that enabled her
to continue to work full time. She takes pride in being a trailblazer for other women in
engineering who are learning how to move up the management track while continuing to balance
work and family. However, she feels the strain of her excessive workload.

“Someone goes, ‘You guys make everything look so easy!’ And you don’t know how
hard everything is. Every single day, it’s hard! Every single day. I don’t even look ahead,
I look behind and go, ‘How did we do that week?’…This is a dual working family, both in the same industry, in an aggressive engineering field, in leadership roles. It is Super. Duper. Hard.”

Given its difficulty, there are moments in Vidya’s career where she questions, “Is this worth it?” It is a difficult question to answer. Flexibility is a dual-sided coin of both hope and instability. While it exists as a possibility, hope remains that the future will deliver on its promises of balance, easy sailing, and “the good life”. On the other hand, flexibility blurs the boundaries between work and home, enabling work to intrude into home life and home into work life. Furthermore, it remains an open question whether increased flexibility will ultimately be a benefit to working women, or whether these policies will drive workplace stigmas and hierarchies that re-entrench women at lower levels of the company. Critical scholars have argued that rather than boosting women’s careers, workplace flexibility has undermined worker protections by redirecting critiques of corporate overwork into conversations about individual time management and work-life balance (Gregg 2008; Martin 1994). However, from the perspective of women engineers struggling for equality, flexibility is a crucial tool, and in many cases, the only one they have. Without it, life is simply unmanageable. Viewing their own careers as part of a larger women’s movement for equal representation in male-dominated careers, women justify great sacrifices in order to break through “glass ceilings” at work. This dynamic pits women’s solidarity against worker solidarity more broadly, generating conflict that is as yet unresolved. This chapter explores the benefits and pitfalls of flexible work practices from the perspective of women working in semiconductor engineering. I show that given the limited options, flexibility is one of the few tools available for advancing women’s equity in the workplace and there have indeed been some promising developments. However, the overall
results are limited due to the individualistic culture of the corporate workplace which prevent these policies from being made available to all employees equally.

**Flexible Labor**

Flexible work is not unusual for engineers in the semiconductor industry, nor is it a new phenomenon. For decades, precarious employment and disciplinary techniques of scientific management have been slowly making their way up the chain of management. Formerly impacting primarily the working-class, the professional-managerial class is increasingly subjected to eroding job stability and the everyday disciplinary regimes of time- and emotion-management. Building upon the previous chapter’s understanding of geographic flexibilization in the semiconductor industry, this chapter explores how this foundational sense of global precarity is overlaid with the shifting ground of everyday flexibility.

Scholars of labor, including anthropologists, sociologists and historians, have critiqued the continuous acceleration of flexibility in the labor force. Weber has argued that Western capitalist work was strongly influenced by the concurrent Protestant Reformation and its valorization of hard work as a tool through which the soul is liberated (Weber 1958). Through cultural values of “good work ethic”, paid work has become a precondition for membership in contemporary society, equating good citizens with good workers (Ong 1999; Weeks 2014; Chamberlain 2018). Under liberal and neoliberal economic regimes, wages have become a material and symbolic indicator of freedom and independence. In her study of the transnational elite, Ong argues that the contemporary neoliberal state shapes our perceptions of deserving citizens, positioning *Homo economicus*\(^1\) as the standard against which all other citizens are

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\(^1\) *Homo economicus* is a term derived from John Stuart Mill’s “economic man”, which he describes as a rational human who acts according to market principles in pursuit of self-interest (Mill 2008). Foucault later critiqued *Homo economicus* as a product of neoliberal economic policies which, through market discipline, create bodies that are
measured (Ong 1999:129). On this scale, wealthy citizens have higher intrinsic worth than the poor while the homeless, the unemployed and other dependents of the state are positioned at the bottom of the social strata. As such, paid employees are often favorably contrasted with slaves, who labor without payment, and dependents, who rely upon others for subsistence (Chamberlain 2018). In the eyes of the state, worthy citizens must be workers.

The general expectation that good citizens will engage in paid labor has been coupled with increasingly intrusive disciplinary regimes over the past century and engineers have played an active role in their creation. During the industrial era, rural subsistence farmers were drawn into cities to work in factories, where Taylorist and Fordist techniques of scientific management were utilized to optimize labor processes. Disciplinary techniques during the early 20th century were primarily over workers’ bodies - regulating their physical presence at work during specified working hours, their behaviors at work, and the number of pieces produced per shift (Nash 1989; Ong 1987; Kunda 2009). The most grueling work conditions were experienced by workers at the lowest skill levels; harsh disciplinary policies gradually lessened as skill levels increased.

Engineers were typically at mid-levels of the corporate hierarchy, positioned between the tradesmen who performed the manual labor and the managers who demanded higher productivity (Zussman 1985). As mid-level professionals, engineers from multiple disciplinary backgrounds - industrial, mechanical, electrical - played a significant role in the optimization of the workplace, developing the machines, tools, and processes by which production could be routinized (Noble 1977). Although this had many positive benefits, including considerable improvements in workplace safety, it also had the effect of decreasing the creative engagement of the working governable, or subordinate to the state (Foucault 2010). Many other scholars have adopted the term, including Ong (1999) and Chamberlain (2018), cited here.
class. Tasks that had originally required a great deal of skill were broken into smaller tasks and distributed to low-paid employees, a process known as deskilling, or standardization (Noble 1977). Importantly, the processes of deskilling and feminization are linked: low-skilled labor is often re-designated as “women’s work” as wages simultaneously decline, as has been the case for clerical work (Pringle 1988) and teaching (Apple 1985). In the manufacturing sector, feminization occurs via distinctions between “heavy” and “light” manufacturing, in which men are associated with the former and women with the latter (Nash 1989:152).

Post-WWII, the emergence of “corporate culture” subjected workers to more intrusive forms of discipline. As opposed to “traditional controls” over workers’ bodies, the new “normative control” conditioned employees’ emotional response to their work environments, seeking to create a desire for emotional attachment, enthusiasm and love of one’s work and company (Kunda 2009:7). Writing in 1956 of the new style of corporate governance, Whyte mused that while the authoritarian employer wanted only your body, “the new man wants your soul” (2013:397). Emerging demands for employees to manage their own emotions at work, as well as the emotions of clients, coworkers, and customers, have been termed “emotional labor” (Hochschild 2012), or “affective labor” (Boris and Parreñas 2010), an exhausting mental endeavor that is part of one’s standard responsibilities as an employee. Although these techniques have perhaps reached their greatest expression in customer service, they were pioneered in engineering corporations such as GE, Dow, and DuPont, who sought to overcome worker resistance to the deskilling and outsourcing of their labor. In order to motivate workers to “put their hearts into their jobs” (Noble 1977:262), engineers were instrumental in the creation of the “science of personnel management”, now standard practice in contemporary corporations (Noble 1977:265). Building upon the understanding that inefficiencies in human activity are a
barrier to optimal productivity, this approach encouraged employees to employ time management and productivity practices, and later expanding into emotional management techniques for reducing losses due to interpersonal conflict and burnout (Kunda 2009). Management’s preference for employees who love their jobs has resulted in what Illouz (2013) has called *Homo sentimentalis*, an economic being who not only strives to be good at tasks but participates in creating a harmonious work environment and expresses passion for one’s work. Weeks remarks that the contemporary discourses of love and happiness at work “finds its greatest resonance within the professional and managerial classes” (Weeks 2017:40). Professions such as engineering, finance and law are examples of what Coser has called “greedy professions”, or those that seek undivided loyalty through passion, long working hours, or other performances of dedication (Coser 1974).

A defining feature of the late-20th and 21st centuries has been the flexibilization of labor. As discussed in the previous chapter, the acceleration of globalization has resulted in the outsourcing of different pieces of the supply chain to locations with cheaper labor. As the pace of development and change increases, flexibilization has also been required at the local level, profoundly impacting the everyday lives of ordinary workers. The meaning of having a job in the 21st century has shifted from prior assumptions of stable employment at a single location over decades to a much more flexible arrangement (Greenbaum 2004). With the increase in flexibility comes lower job security, higher risks of layoffs, increasing competition, increasing qualifications for employment and more contingent, temporary, and contract positions (Greenbaum 2004:36). Even the concept of workplaces has become more malleable. No longer limited to factories and office buildings, any place one can do work might now be considered a “workplace”, including coffee shops, airports, and one’s own home (Gregg 2008).
As in prior eras of “scientific management”, engineers are at the forefront of the flexibilization of labor, particularly in high-tech sectors struggling to compete in areas of rapid technological development. The most precarious of these positions may be the emerging practices of “microwork” in the artificial intelligence (AI) field (Gray and Suri 2019; Irani 2015a). For services such as Amazon’s Mechanical Turk, deskilled tasks are assigned to computers with the hope that one day computers will be able to process complex problems and make sense of the enormous amount of data it has accumulated. Currently, AI programs require an army of human employees to fix mistakes and fill in gaps between what is promised and what the programs are actually capable of. “Integration” is the sister of deskill ing; whatever has been broken into pieces must be put back together again and re-integrated with the original system, usually requiring human labor. In their award-winning book, Ghost Work, Gray and Suri observe that, “the great paradox of automation is that the desire to eliminate human labor always generates new tasks for humans” (2019:xxii). Microworkers are predominantly women who work from home, taking piecemeal work that fits around their household responsibilities. Tasks are simple and tedious, sometimes taking as little as one hour to complete. These temporary employees have little control over their pay, do not receive benefits, have no potential for promotion, and receive no support from the companies that hire them (Irani 2015a).

Microwork is not the only form of flexible labor that tech companies utilize. Qiu (2014) finds in the production of the iPhone that Apple “annihilates the separation between the paid and unpaid labor obligation” creating short circuits between the formal and informal labor sectors. Fan labor and volunteer labor (“playbor”) are sought for troubleshooting and customer-centered design, which feed back into formal design teams. “Bandit” labor, in the form of fake phones and hacked phones, is also funneled back into the formal sector through the licensure of “bandit”
manufacturers. From the viewpoint of the engineer, microwork and other informal roles are invisible, located out of their purview and beyond their regular responsibilities. Nevertheless, engineers are a part of this holistic system, often taking part in the design of deskill and automated processes, while retaining responsibility for the troubleshooting and integration of the system.

Despite its many drawbacks, flexible working conditions are highly desirable, particularly for women and professionals. In semiconductor manufacturing, we do not find exploited low-wage piece-meal laborers; however, neither are engineers themselves beneficiaries of the results of flexibilization. Instead, we find mid-level professionals striving to make a living in a *Homo economicus* world. At this level, flexibility has material benefits, such as the ability to maintain one’s employment in a high-velocity job market - the more flexible the employee, whether by location, job skills, or schedule, the more opportunities become available (Martin 1994:145). Flexibility has also become symbolic of “the good life” within middle-class lifestyles, generating an aesthetic of individual freedom (Gregg 2008). In professional circles, flexible work is preferred, particularly by women, because it grants them additional freedom to manage their households and childcare.

Discourses that frame flexibility as an employee benefit that women demand from their employers neglect the structural conditions that necessitate such choices. The Fair Labor Act of 1938 formulated the forty-hour work week based on an assumed heterosexual middle-class division of labor designed for one (male) full-time breadwinner and one (female) stay-home partner. This arrangement has been exacerbated by the post-1960s acceleration of the middle-class consumer lifestyle which requires two full-time salaries, each of which require 40+ hours per week. Simultaneously, labor unions have been crippled throughout the late 20th century by
“right-to-work” laws, sharply limiting avenues for worker resistance to long work hours and low wages. Women have had considerable success in shifting gender norms within families to encourage men to contribute more to the unpaid labor of the household (Hess, Ahmed, and Hayes 2020); however, in the absence of reliable and affordable care options, the responsibilities of keeping an orderly and functioning household defaults to women (Miller 2014; Parker 2015). Additional studies have found that for college-educated women in high-earning occupations, like engineering, their domestic responsibilities at home are particularly damaging to their careers (Clawson and Gerstel 2014). Left with few practical options to ameliorate their excessive workloads, women turn the discourses of optimization into their own lives, maximizing their own personal flexibility and time management to maintain both a full-time work schedule and a satisfying family life. “In light of previous (failed) visions of labor solidarity, the worker is asked to recognize and accept his or her mobility as the only form of freedom now possible or desirable” (Gregg 2008:290). Berlant has argued that through the practices of flexibility, a new sense of fragility and instability is working its way up through the professional and managerial classes as the individualistic pursuit of flexible success erodes the “affective ties of collegiality and networks of shared obligation” that sustain human life (Berlant 2011:218).

Chamberlain’s (2018) distinction between “employer-friendly” and “employee-friendly” forms of flexibilization are helpful here in directing our focus to the critical question of who benefits from flexible policies. While there are indeed many forms of flexibilization that benefit primarily employers, forms of flexibility that enable workers to arrange their work schedules to

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2 The discipline of engineering, defined as both an “applied” science and a step above “craftsmen” in the labor hierarchy, has historically positioned themselves in opposition to labor unions. Layton (1971) argues that due to engineers’ positive orientation toward, and dependency upon, business, as well as the discipline’s view of themselves as rational and nonpolitical actors, engineers were hostile toward labor actions that might disrupt business operations.
fit around their lives outside of work are an important departure from corporate discipline, albeit in exchange for discipline in other forms. Chamberlain cautions that “employee-friendly” policies are perhaps only allowable because they are not detrimental to corporate profitability, making them essentially “neutral” forces, as opposed to benefitting employees only (Chamberlain 2018:55). Similarly, Henly et al. (2006) have argued that the introduction of flexible hours to the workplace has resulted in greater instability and unpredictability, particularly for women with children. Still, in the context of women in engineering it is often the only tool women have to make inroads for equality. Without flexibility, women struggle to achieve equity with men in the workplace. On the other hand, workers who have embraced flexibility must also embrace the individualist framing of personal time management as the key to success, undermining collective workplace solidarity that would benefit all workers. In this chapter, I refrain from passing judgment on the overall “goodness” or “badness” of everyday flexibility, but simply point out the resulting conflict between women’s representation and workers’ rights more broadly. In this chapter, I lay out the context of flexible labor in the semiconductor industry and delineate the boundaries of who qualifies for flexible work policies and who does not. Next, I present the case for increased flexibility as a challenge for corporations to do more to accommodate families, rather than women alone. Framed in this way, flexibility becomes an intervention that enables both women’s success at work and men’s participation in domestic life. Third, I outline the dark side of flexibility, including the risks of excessive individualism, which obscures the structural factors contributing to accelerating flexibilization, undermines the collective solidarity of women and the workforce-at-large, and contributes to a sense of instability that has been difficult for women to ameliorate. I close by

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3 See also (Henly and Lambert 2014).
bringing attention to a few points of resistance that indicate positive change and a discussion of their capacity for lasting structural transformation.

**Who Qualifies for Flexible Schedules?**

Flexible work hours are perceived favorably by many engineers, both men and women, as a perk or sometimes an achievement after proving one’s effectiveness and reliability. In semiconductors, the phrase “flexible hours” may encompass a range of work practices, including adjusting 9-5 work hours to fit one’s own schedule, coming in late, leaving work early, working remotely from home, or in rare cases, working longer hours Monday through Thursday and taking Fridays off. The semiconductor companies my participants worked in offered two different approaches to flexible work. In most companies, a standard 9 to 5 schedule is the norm with greater flexibility approved for engineers with special circumstances on an individual basis. In some instances, flexible work hours were offered as a contract sweetener to help attract and retain employees. However, one semiconductor company has a very generous approach in that it does not track work hours, vacation time, or sick time at all for professional salaried employees. Instead they have opted for an output-based rather than hours-worked workplace culture. At this company, as long as the work gets done, managers don’t care how many hours employees work or how much time off they take. Although the 9-5 workday remains a cultural norm at the company, the reduced surveillance of hours worked allows the majority of employees to manage their own schedules with less guilt for having to take time off.

In contrast with other professions, part time work is virtually unheard of in engineering. If “official” half-time, 20-hour-per-week employees exist in engineering companies, they are probably for retirees who return to work in an emeritus role. In very rare cases, managers may approve reduced work hours for mid-career employees - 30 hours per week, as opposed to the
standard 40+ hours - to accommodate families with young children, elderly parents, or health-related issues. These reduced hours are a secret option reserved as a last-ditch effort to prevent struggling employees from quitting. During my fieldwork, I learned of two employees who were offered reduced hours. Both were sworn to secrecy by their Human Resources departments, who were worried others would want a similar option if they knew it was available. Disappointingly, the difference between full time and reduced hour positions may be merely psychological. One employee I spoke with got approval to take reduced hours while her children were young. She eventually realized that despite fewer hours, her workload remained the same. The critical difference was that a permission structure had been created for her to do the things she needed to do in her family life. She felt empowered to leave work early and less guilty about doing her work from home. Eventually, realizing that she was doing the same amount of work for less pay, she switched back to a full time role and embraced a more flexible schedule.

Short of an officially reduced workweek, employees utilize flexible work options to help them achieve a balance between work and domestic responsibilities. While flexible work is much desired, it is not usually available to everyone. It is a function of three factors: (1) job requirements, (2) manager approval and (3) seniority. In the first condition, employees are generally divided between engineers who can do most of their work from their desks and engineers who are closer to the manufacturing processes. Desk work tends to have standard 9 to 5 work hours and offers a high level of flexibility. In the semiconductor industry, engineers with desk jobs tend to be housed in one of the following divisions: (a) “Development / Design”, where research is conducted and new products are created; (b) “Integration”, the interface between customers, designers and manufacturing; or (c) business-side support roles, such as procurement and strategic planning. Given that much of their work can be done from their
laptops, many engineers in these positions are able to work from home. While their schedules are relatively flexible, the expected work hours are long. Forty hours a week is the baseline, on top of which many engineers will stay late or take work home in order to meet deadlines, which vary according to project size and client needs. In addition, engineers often come in early or stay late to facilitate overseas phone calls, which recur weekly for the duration of the project.

Other types of work are not perceived as conducive to working remotely. For companies with in-house fabrication facilities, known as “fabs”, engineers are employed to monitor manufacturing processes, troubleshoot problems, and monitor for quality control. The manufacturing floor is operated on shift schedules: the day shift (6am-3pm), the night shift (3-11pm), and the graveyard shift (11pm-6am). Most engineers are on the day shift, but there are typically at least a couple engineers on the later shifts to answer questions and keep an eye on the overnight processes. Manufacturing hours tend to be more routine, adhering closely to a 40-hour work week; however, even day shift engineers are “on call” 24/7 in case of emergencies.

For engineers working in the fab, about 50% of one’s time is spent responding to problems of the day, which requires face to face conversations with coworkers and onsite troubleshooting. Therefore, to ensure the right people are available to address problems, employee work hours are more fixed, work from home is less possible, and there may be emergency calls in the middle of the night. While Ravishankar’s (M, 44, India) work hours are pretty routine from 8am – 5pm, he can expect emergency calls at any time if something goes wrong in the fab.

“When something happens in the system, the whole factory stops. If [the application I manage] dies, there won’t be any way for movement in the factory. Which will affect the yield, and there will be financial repercussions. That’s why you have so much responsibility on your shoulders. Which means at times I have to work long hours. I can expect any call at any time of day. For that reason, many times at midnight, 2am, 1am, I get calls and I work.”
Given the importance of keeping the fab running, it is clear why flexible work is uncommon in these roles. Emergency shutdowns are taken very seriously, since even a single minute down can mean millions of dollars lost. It is crucial that all hands be available in case an emergency requiring their expertise is needed. This can be both a blessing and a curse. On the one hand, engineers on the manufacturing side can expect to keep regular work hours without a lot of overtime, and the separation between work and home is clearer. When work ends, employees can disconnect. However, the rigidity of the hours makes unanticipated domestic issues, such as health problems and family concerns, more difficult to accommodate.

The second crucial factor in being able to flex one’s time is acquiring manager approval. Even if engineers are in a role that theoretically could be performed from home, some managers do not like flexible or remote work, feeling it makes employees less productive. Mingzhu (F, 30, China), who is balancing a newborn baby and part-time master’s degree while working full time, has not been successful in convincing her manager to allow her work from home. His justification for refusing is because her job requires her to communicate with people and for that she needs to be physically present at work. He also told her that it is easier to get laid off if you aren’t seen at work frequently enough. Mingzhu is not sure she buys this theory. She has a couple other colleagues who do similar work and they work from home frequently. “[My manager] doesn’t want me to work from home. Difficult to manage, that’s why. He cannot see what you are doing.” Her manager has compromised to allow Mingzhu to leave work early to take care of her baby whenever needed, but she is not able to conduct paid work from home.

Finally, there is a sense that a flexible work schedule is a privilege that has to be earned, rather than a right available to all employees equally. Some managers require trial periods to
make sure employees can be productive during their time at home. Flexible schedules can also be
difficult for new recruits, who are eager to prove that they are hard-working and reliable. For this
reason, some will voluntarily not take flexible work during their first 6-12 months on the job,
even when it is otherwise available to them. For Durriya (F, 29, India), a recent graduate from
the local nanotech college, the first six months in her new position have been a very precarious
time for her. She is trying hard to make a good impression on her colleagues, double and triple
checking her work, putting in long hours to learn the technologies she is working with. She goes
out of her way to accept all invitations to team lunches, be present for all meetings, and never
takes unnecessary time off. “I don’t want them to think I am not a team player, or that I am
stand-offish,” she says. She felt intensely guilty after taking two days off to finish a couple
publications she has been working on. She had been granted permission by her manager, but at
the last minute, something urgent came up on her team that threw the whole group into a tailspin.
She took the two days anyway, consoling herself that she was new to the position and wouldn’t
be much help anyway. But she worries that her teammates will feel she has abandoned them in a
crisis. With this kind of pressure, it can be difficult for new employees to even ask for a more
flexible schedule.

Switching work groups can also set back the clock on earning a flexible schedule. Even
mid-career engineers on a new team will have to build their reputations as reliable workers anew.
Ilma (F, 40, Pakistan), an engineer with 20 years of experience, has been offered the opportunity
to take Fridays as a remote work day in her new position. Several of her colleagues do this
regularly, flexing their time to take Fridays off to go skiing. Despite a long commute to work and
considerable disruption of her family life, Ilma has opted to come into the office five days a
week, at least until her 90-day probationary period is over. When I ask if 90 days is a formal
probation, she clarifies that no, this is a self-imposed timeline, more for herself than something directly imposed by her manager. She feels that after 90 days she will have had enough time to make a favorable impression on the team and earn her flexible work schedule.

The variation in who is qualified for flexible work is a significant challenge. Flexibility is awarded on an individual basis to employees who have either demonstrated need or earned the privilege. As such, individuals have to argue for their own inclusion under these policies and absorb the risk if they are found not to be productive. Furthermore, employees who do not have demonstrated need, including many male employees, will not be eligible even though they may also wish they had access to the option to work from home. This can lead to resentments between those who qualify and those who don’t. It can also produce hierarchies of work, although these are complex. From one perspective, flexible work represents a high level of achievement, due to the high desirability for these policies and better availability for those at the top of the corporate ladder. From another perspective, those who do not qualify for flexible work may sneer at those who take it, denigrating their commitment and/or contributions to the company. Such divisions undermine worker solidarity as each individual fends for him/herself. Heightened individualism undermines collective action that might bring workers together to argue for flexible arrangements for all workers equally.

**Family Lifecycles & The Case for Flexibility**

One day toward the end of my fieldwork, I got an excited email from Kalpana (F, 30, India) – she had just learned she was pregnant. She and her husband, Chetan, were moving to a new apartment with more space for the baby, so I went over to see the new place and hear about their plans for the future. We sat cross-legged on the couch underneath the remnants of a gender reveal party. Two large streamers were hung up end to end on the wall, one pink and one blue,
and party attendees’ names were stuck to Post-Its with their guesses of whether the baby will be a girl (near the pink streamer) or a boy (near the blue). One indecisive little boy had pinned three green Post-Its on the wall – one under blue, one under pink, and one in the middle with a question mark. Kalpana laughs when I ask about it and says he didn’t really care what the sex of the baby was, he just wanted to win!

Kalpana is in planning mode, trying to make all the arrangements for the baby. Her parents are coming for five months to help with childcare. After they leave, Chetan’s parents will come for a couple months after that. I ask how she is feeling about balancing work and home life, and she takes a practical stance: “I have to go back. That will be absolutely not easy. I can imagine it won’t be easy to leave the baby and go back to work. But that I have to do. That I can’t avoid.” Kalpana’s salaried position in semiconductors has been the couple’s lifeline as her husband has endeavored to get his nonprofit organization off the ground. While the couple is beginning to stabilize financially, it is still not an option for her to stay home, nor does she want to. She enjoys her work and her coworkers, and she has a female manager who is willing to give her the support she needs. She anticipates she will have to rely on her company’s flexible work accommodations heavily during the first few years of being a parent.

Flexible schedules are especially important for women, given their dual responsibilities at work and at home. Most women I spoke with, especially those with children, agreed that flexible time was essential for their success in both arenas, particularly during important life events, such as the birth of a child, and in times of unexpected hardships. Women in semiconductors pursue a feminist ideal of “having it all” - maintaining a fulfilling family life while also holding down a professional job in a male-dominated role. Beyond simply aspiring for self-fulfillment, women engineers see themselves as trail-blazers, fighting for the success of women in scientific fields
for generations to come. Emboldened with a sense of women’s solidarity and a mission greater than themselves, they justify great sacrifices in their lives to create footholds for women in a cultural environment that has made itself hostile to them. A significant factor in this hostility is the institutional resistance to the co-mingling of personal and professional lives. Engineering companies have historically maintained strict separations between work lives and family lives (Kunda 2009; McIlwee and Robinson 1992; Zussman 1985). Although the engineer as a “family man” is one of several normative masculine identities in the field (Faulkner 2009a), most engineers in past decades have preferred to keep work issues at work and domestic issues at home. In this context, women’s efforts to integrate the public/private spheres to more adequately accommodate women’s dual lives as professionals and caregivers represents a significant shift in workplace culture. The recognition of the way the public and private spheres influence each other is an important insight into the lifecycles of families, not just women, and challenges the private sector to do more to accommodate important family events. In this sense, flexibility presents an important intervention that both enables women to succeed and permits men greater ability to participate fully in family life.

Despite this revolutionary potential, the ideals that women engineers pursue are as yet unrealized. Women retain responsibility for the majority of household tasks and there remain cultural stigmas against both women and men who flex their time or need to take leaves of absence for family related issues. Recent research has revealed significant gender differences in the use of flexible work policies. One study found that while both men and women leave work early for family reasons, women are more likely to report it as official time off, while men are more likely to slip out without explaining why (Reid 2015). Another discovered that in instances of high workload and the absence of flexible policies, women tend to scale back their working
hours, while men work more (Miller 2015b). Women’s heavier use of flexible policies results in perceptions that these policies are “for women” and not “for men”. In addition, as I highlighted in the previous section, flexible schedules are not available to all equally, so some employees benefit from these policies while others continue to struggle. For women working in semiconductors, they must fight at an individual level to access the flexible policies that enable their personal success, and by extension, the success of other women following in their footsteps. Accomplishing these goals requires walking a very narrow line between demanding the privilege of flexible work and then proving that they can be as productive or more than coworkers who do not request flexible accommodations. In this way, women enter a double bind in which they can only attain the freedom they need by accepting the burdens of excellence, perfection and continuous comparison between themselves and others.

Although professional women’s struggle to balance work and family life are well documented in the literature (Collins 2019; Gregg 2011; Bailyn 2006; Hochschild 1997; Hochschild and Machung 1989; diLeonardo 1987), I’d like to highlight a few stories, like Kalpana’s, that are particular to women in semiconductors. The presence and absence of flexible work policies at pivotal points in their lives can make or break their careers. In many cases, their experiences are exacerbated by the distance between themselves and their families as a result of joining the global workforce. Kalpana is both a breadwinner for her family and the primary visa recipient as a result of her employment, making it imperative that she maintain her current position during and after her pregnancy. However, she will have to do so without the support networks she might have had if she had stayed in India. This requires careful management of the resources available to her from the federal and state government, her company, and her local community.
The first of these considerations is maternity leave. National and state mandatory leave policies are mediated by workplace culture in determining how long women feel comfortable taking off for maternity leave. The U.S. Family and Medical Leave Act (FMLA) mandates that employers accommodate at least 12 weeks of unpaid leave for family and medical issues. Some states mandate a certain number of weeks of paid leave, at either full or reduced salary. New York State, for example, mandates 10 weeks of paid leave. Paid leave runs concurrently with the federally mandated unpaid leave, after which women may consider whether they would like to extend their unpaid leave to the maximum 12 weeks. After all leave time has been exhausted, some women may be able to work remotely (upon manager approval) before returning to regular onsite work hours. Expectant mothers navigate the complexities of their workplace policies and office politics to carefully plan out how much leave they are able to take, including paid, reduced salary, and unpaid leave.

Kalpana is planning a relatively long leave, taking a full six months at home with the baby. Six months would be considered standard in India, but in the U.S. this is a rather lengthy maternity leave. Kalpana’s calculation uses the entire 12 weeks of FMLA concurrently with 10 weeks of New York State paid leave at a 55-60% reduced rate. She is then taking all of the vacation time she has accrued for the year. After that, she plans to work remotely from home to reach her desired six month leave. Kalpana is able to request such a long period of time off due to having the crucial support of her manager, who is also a woman with children and also works remotely. In addition, Kalpana works on a team with several other women who have children and have taken time off themselves, so she knows she can count on their support during her time off.
Not all women are comfortable requesting such a long leave time. In contrast to Kalpana’s six months, Omala (F, 33, India) took only six weeks off after her first child was born. I met up with her for a quick cup of coffee after work shortly before she went on leave. She was apprehensive about such a short window, but she felt that given the circumstances it seemed reasonable. Also the primary breadwinner in her family, she loves her job and was eager to return to work as soon as possible. Although she described her male boss as very supportive, she is the only woman on a team of all male employees, which reduces the support she might expect from a team with other women.

In engineering workplaces, there remains a common misperception that women will not return to work after having a baby. Although studies have shown that three out of four women in engineering do indeed return to work after their pregnancy (Singh et al. 2013), this does little to dislodge the notion that women are more committed to their families than to their careers. Although recent efforts to extend paternity leave to men could counteract these perceptions, results have been mixed. While a majority of fathers do take some time off after the birth of a child, over 70% take ten days or less (USDOL 2019). Financial stress is also a contributor to men’s reluctance to take leave; few companies offer paid leave for men, and even when they do, fathers feel they need to make 70% of their salaries while on leave in order to provide adequately for their families (BCCWF 2019). The lopsided leave time results in the continued perception that women are not as devoted to their careers and serves as a justification for their lack of promotion and lower salaries relative to men.

In the field of engineering, the damage is not limited to simply questioning women’s loyalties. As Valeria (F, 34, Hispanic American) points out, one person being away on maternity
leave interrupts the team’s daily workflow and can leave women in a position where they have to
fight to get their old projects back when they return.

“When people take maternity leave and get pregnant, the team basically thinks they’re never going to come back. So everyone is basically preparing for [her] to never come back. Literally. ((S: Have you seen this happen?)) Yes. (emphatically) It’s like she got pregnant so now who’s going to cover her stuff? Then [she] comes back and there’s literally no job for her, because everyone took over all of her stuff!”

When I remark that the company is required to guarantee her job, Valeria points out the loophole – the new mother will maintain her position and salary, but all of her work will have been absorbed by other coworkers. At that point, it is incumbent upon her to go back and reclaim her old work (as tactfully as possible) or find a new niche for herself. “So now this person has to go fend for a place,” Valeria explains. “When you’re a new parent, you have all these other stresses, the last thing you want is to try to figure out, am I still going to have a job when I come back?”

The logic of scientific management mandates that the workflow must never stop, making this a difficult issue to resolve. Her projects must continue, so others must cover them in her absence. However, once the projects are taken by others, they are not guaranteed to make their way back to her desk. In this context, expectant mothers tread a difficult line between wanting to maximize the time they can spend with their newborn and minimize the impact on their coworkers and career prospects in the future.

Early childcare is often the most difficult period for families to manage. Prior literature on women and work has firmly established that women’s limited childbearing years conflict with the demands of the workplace (Hess, Ahmed, and Hayes 2020; Parker 2015; Clawson and Gerstel 2014; Miller 2014; Becker and Moen 1999). Women’s limited period of fertility coincides with the period of time when they are expected to prove themselves as hardworking employees and move up through a series of promotions. The necessity of succeeding at work and
the responsibilities for caring for family at home produce a nearly endless day of labor for women, which Hochschild and Machung (1989) have called the “second shift”. Women in engineering fight for more flexibility to manage their work and home lives, while simultaneously taking advantage of hired domestic help, such as daycare, nannies, and housecleaning services. Although these resources make it possible for women engineers to maintain a dual-professional household, they nonetheless shift the burden of their domestic labor onto lower-wage service workers, who are also strained to provide for their own families.

Reliable and affordable daycare facilities are mandatory for new mothers returning to work, but daycare is very expensive in the U.S. Even among families with two engineering salaries, daycare costs can be so expensive that it may actually be cheaper for engineers to stay home than to send their children to daycare. In addition, daycares can be quite strict about drop off and pick up times. During my second interview with Wangshu (F, 38, China), we lost track of the time and she had to run out the door to pick up her daughters at exactly 6:00pm, otherwise she would be charged a late pickup fee. While these strict daycare policies are understandable for protecting the sitter’s time, they make it difficult for women to stay late to meet deadlines or attend evening meetings. This can be a problem if women’s managers are not supportive. Janaki recalls a manager who insisted on scheduling meetings at 5:30pm. Meetings after hours were a good time for him, since his typical 9-5 workday was consistently filled with meeting requests. Janaki (F, 42, Indian), on the other hand, had to get home to pick her kids up from sports practices and make dinner for her family. She had informed her manager several times that she could not attend meetings after 5pm, but he repeatedly ignored or forgot her requests. As a result, she missed important information required for her job and her reputation with her boss was damaged by the perception that she prioritized her family over her work.
Furthermore, in an effort to prevent the spread of colds and flus, schools and daycares send children home when they are sick. During the course of my research, both Asha (F, 32, India) and Mingzhu (F, 30, China) ran up against these policies during times when they were living separately from their husbands as sole caregivers. For two weeks while her daughter had a mysterious ear infection, Asha was only able to come in to work two days a week. Fortunately, her manager gave her permission to work remotely the other three days per week. Mingzhu did not have that luxury. As the sole caretaker of a newborn prone to ear infections, she had to use her own sick leave to take off work. “He is always sick. Always sick. I’m considering taking vacation first, then maybe unpaid leave. If I really don’t have a choice. Then unpaid leave. That is about work life balance. I have no other choice.”

While raising young children is one of the most demanding times for working families, it is not the only accommodation that families will need throughout their working lives. Family emergencies, while treated as isolated, unpredictable events, are something that every family will experience at some point. Such emergencies might include health problems, deaths in the family, childcare emergencies, which impact workers regardless of life stage, marital status, or presence/absence of children. The fact that workplaces are ill equipped to accommodate such scenarios is a remarkable failure of planning and a reminder that the system is predicated upon a strict separation between work and domestic life.

Carmen (F, 37, Puerto Rico) experienced workplace conflicts when two of her adult family members simultaneously fell sick.

“We had just moved here. My husband was having all these issues with his mom [who had kidney failure]. My dad actually also got really sick, he was diagnosed with lung cancer. So [my husband] is trying to take care of his mom. I’m trying to fly to Puerto Rico to take care of my dad…and my boss was just not having any of it. None of it. None of it. He was just very unhappy with…I would take a Friday off to go visit my family. I’d
have to like, rush and take a phone call from the doctor or whatever. He just did not like that. He was very unhappy.”

Carmen’s boss was generally not supportive of flexible work schedules, but her case was complicated by the fact that she was in her informal “probationary period” when disaster struck, causing her to start off on the wrong foot with her new manager. Would it have made a difference if she had established a reputation first as a hard-working employee? It is hard to say. Carmen thinks maybe not. “I personally think he just likes control. And he wasn’t in control. And he didn’t like people looking at it as ‘she’s insubordinate’. So he didn’t like that.”

Some women, experiencing the brutal reality that the workplace does not accommodate working mothers, do end up leaving after all. Interestingly, most women who leave engineering do so to pursue other careers, not to stay home permanently (Singh et al. 2013). Carmen reflects on a friend who left engineering:

“I had a couple of friends who basically decided that engineering was just too demanding of a career when they had their babies. One of them decided to find a teaching job, so she’s a teacher now. She’s a very good teacher, but…she was a really awesome engineer. (laughs) To me that’s kind of a loss. She was a very good engineer and she basically said, ‘I wanna be present for my children’s birthdays, to spend summers with them. That’s something that engineering won’t let me do.’ So she left.”

For women like Carmen’s friend, it wasn’t the case that she wanted to stay home with the children full time. Rather, she wanted a full time job, but one that would allow her to spend more time with her family. In this case, teaching, a profession that has already undergone feminization (Apple 1985), allowed a more flexible schedule than engineering could offer.

Despite this continued struggle to find balance, flexible work is one arena in which the strict separation between work and domestic life is challenged. In particular, shifting to outcomes-based work cultures and performance measurement relieves pressure on women to be physically at work 40-60 hours a week, freeing them up to more efficiently manage their
domestic responsibilities. Leena (F, 41, India), for example, works for a company that has completely eliminated time reporting from its workplace practices. Over the course of her career, she has experienced multiple incidents that required her to take short term leaves of absence. She thought on multiple occasions her company would fire her for taking too much time off, but due to their extremely flexible leave policies, she was able to continue working. She does not even recall how many days she took on her last leave because it is not tracked and there is no limit on how many days she can take. Thus, flexible leave policies make it much easier to address unforeseen issues, large and small, and have the potential to dramatically improve equality at work for women. The fact that some companies are beginning to adopt these policies represents a significant structural shift toward creating more space for family life alongside full-time occupations.

The Dark Side of Flexibility

However, the promise of flexibility is yet unfulfilled and contains significant risks. First, the framing of flexibility as an accommodation for families, rather than for women alone, is a nuance that is not yet fully accepted in corporate culture. The widely-accepted notion that flexibility is solely for women risks the creation of a new underclass of women professionals who are stigmatized for being not as committed to their work and who will experience negative bias in promotion reviews. Second, these policies represent an erosion of workplace stability that has led to the exploitative work practices experienced by microworkers. While semiconductor professionals are currently protected through their salaried employment, the risk remains that erosion at the lower levels will continue to progress up through the professional band under the guise of the highly popular rhetoric of individual freedom and flexibility. Third, the reliance of
these policies on individual achievement undermines collective solidarity that would extend these policies to all workers equally.

Feminization in the Engineering Profession

Flexible work policies are gendered in that it is assumed that women will be the primary beneficiaries. Due to women’s continued association with domestic labor, it is presumed that only women will need to utilize flexible policies at work, while men can continue to work a standard 9 to 5 work schedule, plus any required overtime. This perception contributes to stigmas that stereotype men as more committed to their careers and women as privileging family life over work. As a result, women are negatively impacted by stigmas that devalue flexible work practices and promotion biases that presume that they lack the commitment necessary for management roles. At the same time, men are subtly discouraged from using flexible policies themselves through cultural signals indicating that such policies are for women only. The strong associations between flexible policies and women risk the emergence of a new feminized underclass of engineering labor who become stuck at low levels of the engineering hierarchy.

Despite strong preferences for flexible work among both men and women, the stigma that equates not being at work with not working remains a persistent feature that flexible workers grapple with. These negative biases are not based in any objective productivity measure. Over 70% of employees who work from home report that they are MORE productive than they would be onsite (International Workplace Group 2019) and popular perceptions often neglect the significant amount of time onsite workers spend hovering around the coffee station and having casual conversations. One study found that remote employees work on average 1.4 days more per month than onsite counterparts, had higher focus and fewer distractions, and spent half an
hour less per day in non-work-related conversations than their onsite counterparts (Airtasker 2019).4

Regardless, the perception that being onsite counts as “working” and being offsite is “not working” persists, and women are frequently the targets of this negative bias. On the way home for a doctor’s appointment, Ilma (F, 40, Pakistan) passed someone who chided her, “Are you going home already?” Ilma did not perceive it as a joke, but even if it was, she felt stunned. With this off-hand remark, her coworker had called into question her reputation and dedication to her career. For many women, the fear of similar comments manifests in a constant feeling of guilt over taking time off to care for themselves and their families. Following the birth of her children, Vidya felt so guilty about not being able to give 100% to both her family and her workplace that she seriously considered quitting. “It mattered to me. What would they think of me? Would they think I’m not a good worker? Do I really deserve to be here?” Even without anyone saying anything directly to her, she felt pressure from a workplace culture that was entirely arranged around being physically present at work. As the only employee in her group who was flexing her time, she felt she was being silently judged by her coworkers. The stigma against working from home is particularly harmful for women, who are already presumed to be less committed to their jobs, and their absence registers as additional evidence that they are not working as hard as men.

Men who want or need to use flexible work policies find that there is an additional stigma towards men who flex their work hours. Many men in semiconductors report feel uncomfortable leaving work in the middle of the day. Leena (F, 41, India) points out that while it is usually okay

4 These studies were conducted prior to the COVID-19 pandemic when crucial structural supports were widely available, such as daycare, in-person public school and other activities important for sustaining mental health. These conditions have almost certainly changed during the pandemic, when women have struggled to provide childcare while maintaining full time jobs.
for her to flex her time, her husband feels it reflects poorly on him to leave early in the afternoons.

“I think the judgment goes against men as well. So many times I have to leave early from work. To pick up the kids or whatever it is, right? Again, [at my company] it’s okay. It’s easy. But in [my husband’s] company, if he does that too often, people frown on him. But if a woman did that, they wouldn’t frown at her as much. They’ll categorize her. She’s a woman, family must be her first priority. Which means obviously she doesn’t want to rise up in her career. So you see it’s a chain reaction…So again, when we say about how the perceptions have changed, and who’s judging whom, it’s going in all directions.”

Her husband is not imagining this dynamic - studies have shown that when men need to leave work for family reasons, they are more likely to slip out quietly to avoid drawing attention to their absence (Reid 2015). Among highly educated men, in particular, there is often the desire to spend more time with their families and contribute more to domestic labor (Pedulla and Thébaud 2015; Gerson 2011). However, faced with the demand for men especially to put in long hours at work, they often opt for a traditional breadwinner role in family or a “neotraditional” arrangement, in which they retain the breadwinner role, but share some domestic tasks with their spouses (Pedulla and Thébaud 2015). Stereotypes that push men to spend more time at work re-entrench gendered divisions of labor and demonstrate that flexibility stigmas are harmful for everyone, not just women.

In addition to the cultural narrative that tells women they are not doing enough, flexible positions may negatively impact an employee’s promotion opportunities (Jacobs and Gerson 2015). Studies have shown that in situations where flexible policies are needed, such as the birth of a child or a family emergency, women are more likely to flex their hours and scale back their effort at work, contributing to a “motherhood penalty”; in contrast, men work harder and put in longer hours, contributing to a “fatherhood bonus” (Miller 2015a; Miller 2014). This dynamic is
especially pronounced in high-earning careers, wherein women are scaling back at the exact time as men are scaling up (Clawson and Gerstel 2014).

In engineering, there are hints of flexible tracks for women that isolate them in low-risk, flexible work groups with little opportunity for promotion. Michael (M, 56, White American) recalls a time when he had to switch to a more flexible role. He was a single father when his son was young, making it difficult for him to work long hours or be on call for late-night emergencies. He could not leave his son at home alone in the evenings and babysitters were not always available at the last minute. When Michael would get calls in the middle of the night, if he couldn’t fix the issue from home, he would have to call his boss, who was not happy to have to go all the way in to work to cover for his employee. Eventually, Michael transferred into a position that he describes as a haven for employees with families. His new boss shielded his employees from late night calls and allowed them a great deal of flexibility when conflicts came up with their kids. The group was mostly women, an anomaly in engineering, with a few men transferring in and out. However, there was a downside: getting promotions within this group was extremely difficult. Michael was lucky to be transferred out of the group once his son was grown, but many of the women he worked with at the time are still there, in relatively the same positions they held many years ago.

The revelation that there exist pockets within companies that cater to employees with families but do not advance them up the management track is concerning because it indicates the early stages of feminization in the engineering workplace. Feminization within professions has been noted in other fields such as teaching, formerly a male-dominated career. After women entered the profession in large numbers, they gradually became associated with elementary and secondary education, while men continued to dominate the more prestigious levels of higher
education (Apple 1985). Engineering did not truly begin its route to gender equality until the late 1970s (Rossiter 2012). Now, as women are approaching a critical mass in many engineering disciplines, scholars and women’s rights advocates should be watchful for indications of feminization of the field. In engineering, feminization may occur along lines of routinized or “low priority” work in the company. Although work groups such as the one described above may be well-intentioned, offering a place for employees with families to take a “step back” to raise their families, there should be a simultaneous effort to provide “paths in” and “paths out” equally, in order to support these employees once they are again ready to move forward with their careers.

**Extended Work Hours**

By allowing work to intrude into after work hours, employers are able to extract more work from employees, frequently without overtime compensation. Research in other industries shows that the benefits of flexible working arrangements may justify paying employees less or compensating only certain work activities. Women working remotely with children at home tend to overcompensate by working longer hours to avoid the perception of unprofessionalism (Gregg 2008). Studies of Amazon’s Mechanical Turk freelancers and other microworkers (Gray and Suri 2019; Irani 2015a) find that workers are paid only for the time spent completing the tasks assigned, but not for the labor that goes into searching for tasks, researching and training, and communicating with managers when something goes wrong. In semiconductors, the nature of engineering work in the formal sector guarantee workplace protections and relatively high salaries, mitigating some of the risks of exploitation. However, there is evidence of slippage wherein some kinds of labor are not perceived as worthy of compensation.
Leena puts in long hours each week, and the fluidity between work and home means she is never fully “off the clock”. Her typical day looks something like the following: She wakes up at 7am to pack lunches for the family and get the kids ready for school. She is in the office by 9am and her day is spent in a flurry of meetings and making sure the employees she manages have what they need to do their work. She eats her packed lunch at her desk while she continues working – she doesn’t like to waste her lunch time since it is one of the few times during the day she can get things done on her own work agenda. On a good day, she will have at least one hour to work on technical work, which is what she really likes to do; this is not always possible. Twice a week, she hires a nanny so she can stay late at work to finish important projects. The other three days a week, she leaves the office at 5pm to pick up her kids. As soon as she walks through the door of her house, she heads straight to the kitchen to prepare dinner: “If I let myself sit down, I will be too tired and I will never get back up again!” While she cooks, she prods her kids to practice piano or do gymnastics training. After dinner, there is cleanup. She has devised a foolproof way to get her husband to help: she gives him a choice, either doing dishes or putting the kids to bed. Usually she ends up with the dishes, which she enjoys because she can watch TV while she works. She finally heads to bed around 10pm, usually reading a chapter of a fiction book to help her relax. Throughout the evening, in the car ride home, during meal prep and cleanup, she is also puzzling over problems from work in her head, trying to come up with solutions, thinking about what to put on slides for presentations. She says this makes her more efficient. When it is finally time to sit down and create the slides, it only takes 5 minutes because she already knows exactly what she wants to put on them. “The company is getting a very good deal!” she exclaims as she considers how much time she spends outside of work still thinking about work.
Like Vidya’s flexible schedule from the opening vignette, Leena’s typical day is an example of a workday that spills beyond the 9 to 5. Vidya may not think it’s worth it to track her late night hours checking email, or Leena might not realize how much time she spends pondering work problems while washing dishes at home. However, these are still forms of labor that are valuable to the company: emotional labor in preparing for tomorrow’s conflicts while lying in bed at night, organizational labor in planning Powerpoints on the way to work, analytical labor in thinking through difficult concepts while watching the kids at swim practice. Whereas onsite overtime work is easy to track and reward in hourly overtime pay, offsite overtime has less visibility and is often framed as “doing what needs to be done” rather than labor that demands compensation.

These scenarios reveal the darker side of flexibility. When the boundaries between work and home are blurred, not only is the company making room for domestic life, but the opposite can be expected in return: workers are expected to make their home lives more flexible to accommodate the company. In one extreme example, Jihan (M, 47, India) tells me about a previous job where he regularly worked 14 hours a day. He was physically located in Canada, working remotely for an American company, training employees in China. His day started at 8am local time, but since most of his clients were in China, he would typically work until 8 or 10pm hosting conference calls. It was a very grueling time for him. “I had no idea what I was doing! I am thinking this is not right!” Eventually, Jihan was able to maneuver to a job with more amenable work hours. However, these grueling jobs persist, particularly for entry-level and/or immigrant employees who are looking to prove themselves in their careers and perhaps are not as aware, or not in a position to push back on exploitative work environments.

Flexible Mindsets
Early in my field work, I was astonished at the hyper-efficiency practiced by engineers in this field, particularly by women. Given my own background in the highly-regimented field of engineering, I had thought myself an efficient and productive person, but hearing women like Vidya and Leena describe their typical days - squeezing in more activities than I would have thought humanly possible, eliminating wasteful time, multi-tasking – I felt exhausted and overwhelmed just as a listener. Among women in this field, methods of hyper-efficiency, puzzling over work problems all day long, and the harnessing of momentum to keep themselves moving are common refrains.

Such routines require extreme discipline over both the body and the mind. In the modern professional workplace, “traditional controls” over workers’ bodies, through strict working hours, scheduled breaks, pieces per minute, have been superseded by “normative controls” in which workers are entreated to discipline themselves (Kunda 2009). Such disciplinary practices are what Foucault calls “self-technologies” in which subjects perform “operations on their own bodies, on their own souls, on their own conduct, and in this manner to transform themselves, to modify themselves, or to attain a certain state of perfection” (Foucault 2016:25). Gregg notes that modern time management techniques have gradually replaced the role of secretaries; professionals are now expected to manage their own schedules, effectively absorbing the work that once required two full-time positions, while eliminating a lower-skilled employee (Gregg 2018:6). Given that these time management practices do not typically recognize unpaid labor in the household as “work”, women are left to squeeze household duties into small pockets of surplus time after all other work categorized as “high importance” is completed, or alternatively, to offload that work onto service workers in the form of daycare, after-school programs, or housekeeping (Gregg 2018:12).
Women in semiconductors embrace the disciplinary logic of productivity as a key mindset which enables them to accomplish superhuman feats of will. Time management strategies help densely pack activities, reduce the number of trips, and align high priority activities with prime work time. Many employees open up their laptops for an additional hour or two of work in the evenings after the chores are done. Assessments of “wasteful” effort enable their elimination from the schedule. Some women sacrifice their bodies, skipping lunch or neglecting exercise, in order to accomplish more. Others exert additional willpower to exercise, meditate, or read for pleasure, on the theory that escaping illness and burnout is a better long-term strategy. Consider Vidya, who structures her day to complete her high importance tasks at work from 8am- 2:30pm and reserves easier tasks, like responding to email, for the end of her day while she is watching her children after school. By splitting her day into high energy and low energy segments, she can multitask paid labor and childcare, balancing the demand to be “on the clock” with the demands of being a good mother. Her time and energy are carefully structured and require the sacrifice of some of her own needs, like skipping lunch. While Vidya chooses to work in the evenings, using this time to anticipate the obstacles she may face the next morning, Leena feels this leaves her too burned out to be effective the next day. She prefers to use the last few hours in the evening for rest and restoration. This practice demonstrates an alternative definition of efficiency, taking into account the impact of personal wellbeing on long-term resilience. One study asserts that women in engineering are more likely to adopt holistic, long-term views of efficiency than their male peers, who are more likely to consider only short-term gains (Mallette 2017). Even this alternative focus on long-term resilience requires discipline, requiring women to resist the urge to pack all of their time with productive work and to redefine their own health as a priority worth investing their energy and time, both limited resources.
Although each woman’s assessment of values and priorities are different, the strategy and energy required to maintain this discipline are similar.

Maintaining a positive mental state is another form of self-discipline that is essential for maintaining momentum and motivation. Many women I spoke with deliberately kept their internal messaging positive, telling themselves that their workloads between home and work weren’t so bad, refusing to allow themselves to sink into self-pity. Despite her encounters with coworkers who chide her for having to leave work early to pick up her kids, Ilma chooses to downplay the impacts of discrimination by race or gender at work. “You can’t think like that,” she tells me. “You would never get anything done.” This is not naïveté, it is pragmatism. It would be too easy for her to be dragged into a negative tailspin by others’ thoughtless comments and fail to complete her own work. By carefully screening negative thoughts, she is more able to maintain her focus on things she considers to be more important, like her daily work and career aspirations.

Other women have adopted the self-disciplinary practice of “growth mindset”. Growth mindset is a technique currently popular in management training courses that encourages individuals to adopt a learning attitude toward every experience. Its binary counterpart, “fixed mindset”, is a state in which people have stopped learning and simply execute tasks they are assigned. One of the key benefits of growth mindset is its interpretation of obstacles and failure. Mistakes, for people with fixed mindsets, are internalized as individual failures. The feeling that one has failed is an impediment to productivity in that it impedes their ability to ask for help and prevents forward movement. Alternatively, from a “growth mindset” perspective, mistakes are not perceived as failures, but as incidents that produce learning and understanding. This mental
shift enables individuals to quickly overcome the trauma of failure and move more quickly back into productive activity.

Growth mindset is a particularly effective tool for individual self-management during a time of increasing flexibilization of the workplace, in which the worker is likely to experience a high degree of volatility in their careers. Didn’t get that big promotion? Use it as a learning experience so you can improve your skills for the next time. Weren’t able to successfully juggle work, family and leisure this week? Adopt a growth mindset and figure out what to tweak to achieve better balance next week. Both positivity and growth mindset do have positive impacts on mental health in that they shift the focus away from things that are uncontrollable and put individuals back into a position in which they are able to function normally in the world. However, they simultaneously distract from the structural conditions that are causing the volatility. By focusing their efforts on their own internal navigation of obstacles, it is easy to ignore the fact that there is no support for child care, little time for domestic maintenance, and declining job security for workers.

**Flexibility: The Only Viable Option**

In contemporary anthropological studies of power, we are often entreated to look for resistance as a response to power. Foucault writes that “at the very heart of the power relationship, and constantly provoking it, are the recalcitrance of the will and the intransigence of freedom” (Foucault 1982:790). Feminist scholar Ahmed has theorized complaint as a form of resistance and a window through which we catch a glimpse of individuals’ visions of a more just society (Ahmed 2021). Therefore, it is notable that engineers rarely complain about the extreme efficiency demanded by flexibilization. In semiconductors, while a few, like Jihan, express dissatisfaction with the daily grind of working life, they do not direct their complaints at
companies, which have the power to change local working conditions and culture. Instead, a generalized idea of global economic competitiveness is an accepted justification for the importance of high efficiency and long work hours. It is generally not questioned whether such long hours are necessary or whether work that takes place after hours should be compensated. The lack of complaint is curious and reflects cultural understandings of “the way things are”. John and Jean Comaroff have famously claimed that hegemony, in its most effective form, is mute (Comaroff 1991:29); institutional power is strongest when it is no longer argued, but accepted as reality. Engineers may be particularly hesitant to ask such questions due to the discipline’s cultural aversion to political action and historical dependence on industry to set the direction of their work (Goldman 2004; Layton 1971). Alternatively, lack of complaint may be rooted in engineers’ lived experience and understanding of its futility; complaints about these features will likely not be successfully resolved, so employees learn to live within the expected boundaries.

Instead, seeing the possibilities for change along the lines of flexibility, employees have chosen this as the avenue most promising for enabling a fulfilling work and family life. They argue for their own flexible work scenarios and push to make this practice more acceptable, for both men and women. Vidya and Mark have taken this on as a personal challenge. Now that she is more established in her career, Vidya intentionally tells everyone that she is taking off to pick up the kids. “I have no shame anymore. I get up [to leave work] and I make a huge thing of it.” When she was younger she got advice from a male colleague to never give kid-related excuses for why she had to leave early from work. She feels that this was a disservice to herself and to everyone else around her. Now her attitude is, “I dare you to say something to me about this. I dare you.”
Mark also tries to set an example for his employees that it’s okay to leave work for family-related activities. He takes it a step further, refusing to check email on vacation – a step Vidya has not yet had the courage to try herself. Vidya explains the importance of managers setting an example for their employees:

“You have to be blatant about it. When you see your boss [flexing his time], it’s going to be okay that you do. If you see your boss not behaving in that manner, it’s not going to be okay. [As managers], we have that responsibility. I am purposely more vocal. I take that phone call [from the babysitter]. I do it there and I do it in front of everybody and everybody gets involved.”

By encouraging managers to lead by example, they hope to break down the boundaries between work and domestic life, encouraging all employees to enter their work lives as whole people with families. They also hope to break down gendered expectations of flexible work, reducing the stigmas that flexible policies are “for women” by demonstrating why they are also useful for men. Indeed, one of the semiconductor companies studied has started along this path, setting “employee-friendly” flexible work hours as a baseline benefit for all employees and ended the practice of tracking vacation and leave time entirely. Although there remain reported gender disparities in men’s adoption of flexible schedules, at least it resolves the problem of differential access.

Conclusion

For women in semiconductors, flexibility is the major factor that allows them to balance their work and their home obligations. In these upper echelons, we find not exploited and underpaid freelancers as those found in microwork, but women struggling to make it in a male-dominated domain. Flexibility is key to their success. I have found it useful to distinguish between “employer-friendly” flexibility which is wielded to justify underpayment and overwork of employees, and “employee-friendly” flexibility, which allows individuals more freedom to
manage their own schedules, while paying a living wage (Chamberlain 2018). When coupled with worker protections, flexibility can be seen as a demand for corporations to allow more space for domestic life. However, a far better solution would be to reduce workloads to a level that all employees find manageable. Most companies instead end up with a gendered arrangement where the same heavy workload is demanded for all, but women, in particular, are granted the “freedom” to manage their own schedules, given that they prove themselves exceptional. Until companies begin to alter their own institutional structures to accommodate family life as an important and immutable part of human obligations, women will be required to make themselves ever more flexible to sustain their families.

Employees in the integrated circuit, particularly women, embrace productivity tools such as time management and growth mindset because they enable them to fulfill their dreams of “having it all”, balancing a successful career with a happy family life. Flexibility thus comes to be seen as a god-send, a gift, a benefit. However, “work-life balance” is an ideal that is almost entirely based in productivity logic, reasoning that if a woman is efficient enough she can squeeze all of her conflicting responsibilities into a single day and still have time to enjoy the life she has built. Chamberlain argues that flexibility eventually becomes a destructive force, as “the flexible worker becomes an agent of his or her own subordination through ongoing process of self-disciplining” (2018:65). Although they are exhausted and many complain of the gender gap in work-life balance, the discipline of extreme productivity is a price many are willing to pay. However, a crucial question lingers: is this worth the sacrifice? Is this a humane and sustainable path?

The diminishing returns of intensive flexibility generates what Berlant has called “cruel optimism”, or a condition in which “something you desire becomes an obstacle to your
flourishing” (2011:1). In the pursuit of “work-life balance”, semiconductor engineers optimize their time, de-skill tasks into simple, manageable chunks, and carefully manage their emotions only to find that they never reach a point of safety and rest. Instead, they find that balance is something that must constantly be made and remade. In the process, women unknowingly pursue individual success at the expense of creating meaning in other areas of their lives and discover that the promises of “having it all” are realized only in glimmers, small moments in the chaos of their lives.

A close look at the practice of everyday flexibility reveals three core problems in the way it plays out in this context. First, flexible policies are only available to few, not widely available to all. By individually adjudicating who is able to attain flexibility, employees who do not receive these accommodations are left behind. Second, flexible work policies are largely perceived as benefits for women, rather than a mandate for families, running the risk that this will reinscribe notions of women’s and men’s work and contribute to feminization in particular sectors of the engineering workplace. Third, adaptations to flexibility, such as time management, obscure the structural conditions that mandate flexibility by focusing solely on individual self-discipline. Although collective demands for widespread flexible policies might do more to establish these policies as worker’s rights, employees have instead largely bought into the concept of flexibility as a privilege that they must strive to “earn” through demonstrations of exceptional productivity and achievement.

A resolution to these conflicts might be found in the recognition of the use of flexible policies to accommodate the lifecycles of families, not just women, and in a challenge to the private sector to do more to acknowledge domestic responsibilities. Chamberlain argues that employee-friendly flexible policies are a “privatized response to the contemporary deficit of
care, which has its roots in shrinking public support for care work and the expansion of women’s labor force participation” (2018:67). One possible solution is to reconsider our approach to care, mandating that domestic accommodations should be available for all workers, at all levels of the social hierarchy, as a contemporary movement in workers’ rights, as Chamberlain recommends. Another possibility would be to treat domestic labor as an economic activity, assigning it monetary value paid by the state, in order to make visible the labor involved in these efforts (Tzannatos 1999). Women engineers should take heed of the ways in which their work in the professional band effectively delegates their families’ care work onto other labor sectors, such as education and childcare, and demand that these workers’ domestic labor be accommodated as well. Rather than viewing care as a privilege that each family must provide individually, we can rethink access to care as a right that should be provided as a social benefit to all workers collectively. Assuring that all workers, men and women, have additional time and flexibility to contribute to domestic labor resolves many of the issues in women’s ability to compete on an equal footing with men in engineering and that flexible work policies do not become a technique of workplace feminization. It also would avoid, and possibly improve, class distinctions in who has access to care, so that women engineers’ success need not depend on childcare providers’ sacrifice of their own families and well-being. Finally, by ensuring that families have time and energy available for their domestic obligations would slow the pace of employee insecurity in this rapidly destabilizing global workforce, enabling workers to devote more of their own time to creating communities and strong family networks that are so crucial to feelings of belonging and stability in a rapidly changing world.
CHAPTER IV
Negotiating Engineering Identity in the Multicultural Workplace

In the hallway that lines the outer shell of the building hangs an array of photos taken by employees. Each photo is uniformly rectangular – horizontal 11x17-inch canvases – lined up in neat double parallel rows down the length of the hallway depicting beautiful images captured by employees. A bunch of colorful tropical flowers, the stone figure of the Buddha with his circular curls, a temple monkey licking a pint of ice cream clean. Every time I pass, I am captivated by a photo of a little girl, her brown skin and straight dark hair contrasting with her yellow skirt circling out around her, the whiteness of her smile as she beams up into the camera. These photos are a symbol of the multicultural nature of this workplace. They feature the wide range of natural environments, people and objects that have been captured from around the world, woven into a single, seamless display.

At first glance, this corporate campus seems much like many others in the United States. Following the trend pioneered in the 1940s and 50s by corporate giants such as AT&T, General Electric and General Motors (Mozingo 2011), the company chose a site well outside city limits, building a campus entirely self-sufficient for its employees. It has the mandatory gated entrance, fitted with a security shack. The manicured landscaping is green in the summer, with carefully placed trees and shrubberies, its dark flowerbeds featuring a different array of colorful annuals every year. There is a cafeteria, a fitness center, and two meditation rooms. In many ways, it is very similar to several other corporate campuses I worked on in my own career as an engineer.

However, looking more closely, it becomes apparent the extraordinary diversity that is sheltered within these hallways. My yoga classes are filled with employees from all over the world – India, China, the UK, Ireland, Pakistan, Malaysia, Korea, Singapore, Myanmar, etc.
Flustered by unfamiliar names at first, I began carefully repeating everyone’s name to make sure I was pronouncing it correctly, and then did my best to memorize it within 2-3 classes - a small gesture to make my students feel more welcome in my class. As I have gotten to know the people who work here, they remark to me how much they love working in a multicultural environment. While other multinational companies in the region are comprised of mostly American employees, this campus boasts of hosting workers from 51 countries, making up nearly 35% of all employees at the site (Cropley 2019). This is one of the most fulfilling parts of working in the global circuit – the ability to learn about countries and cultures that they might have never interacted with if they hadn’t pursued this career.

However, the integration of engineers from across the world into a single, functioning company can be difficult, and it becomes clear that when working in the U.S., you must play by American rules. English-Leuck (2011), studying tech culture in Silicon Valley, California, has remarked that on the West Coast, tech companies have cultivated a culture that integrates both “deep diversity” and “deep toleration”, in order to support the efficient and seamless teamwork amongst employees from around the world. This multicultural tolerance extends from within the companies themselves into the surrounding communities, enabling individuals to develop complex multi-faceted identities that help bridge cultural gaps. My research in semiconductor engineering on the East Coast reveals similar efforts within semiconductor companies, whose employees make great efforts to reach across cultural boundaries to find connection with their colleagues. However, we should not mistake multiculturalism for equity. Martin points out that

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1 The publicly reported figure is that 65% of employees are hired locally (Cropley 2019), but participants have often remarked to me that 60% of engineers at this site are foreign workers. This could be due to perception bias, reflecting the high visibility of minority engineers. It may also be a discrepancy between professional bands, with local employees concentrated in technician roles, while immigrants are hired for engineering positions that require higher degrees and specialized expertise.
often celebrations of diversity overemphasize the appearance of harmony and mask the differentials of power and resources that exist between individuals and groups (1994:247). Indeed, Ameeriar in her study of migrant professionals’ struggle to find jobs at their skill level in Canada, observes that “the public discourse of multiculturalism acknowledges inclusion and creates a body politic that imagines itself to be accepting and tolerant of cultural difference, while in reality it ignores how immigrant bodies are being raced, gendered, sexualized, and then excluded on the basis of those differences” (Ameeriar 2017:13). In the context of semiconductor engineering, I find that multiculturalism is a difficult system to manage, given cultural variations in how engineering work is done, and the dangers of misunderstanding these differences. Furthermore, the company’s location on an American site dictates that migrant workers are locked into American ways of doing business, despite their own preferences, and therefore face challenges in their bids for recognition at work.

One of the core goals of this project has been to study the subtle forms of discrimination due to gender and race/ethnicity in the workplace. For many of my participants, discrimination at work is difficult to ascertain, since so much of their work takes place in a context where what is “normal” is so highly contested. There are multiple layers of bias to work through, from more recognizable gender and racial biases, to the complex boundaries between nation states, religions, age groups, and even company cultures.

Some types of bias are stable and instantly recognizable. Focusing on gender alone for a moment, the caricature of the pure and rational scientist is an enduring trope that has been the basis of evolving scientific gender ideologies over centuries. This draws upon culturally-accepted, if largely unfounded, gender ideologies that map emotionality onto femininity and, by extension, onto women, while the world of rationality, logic, and evaluation are the domain of
masculinity and men. Noble (1992) has argued that the gendering of scientific disciplines has its roots in early Christian clerical culture, wherein early scientists were entreated to practice celibacy in religious pursuit of truth, an essential rejection of sexuality, and by extension a rejection of women as a source of pollution and temptation. Herzig (2005) uncovered similar underlying gender ideologies in early 19th century scientists, wherein male “purists” were contrasted with female “pragmatists”, male “explorers” with women who stayed close to home, male “barbarians” with female “beauties”. In more modern constructions, in order to be perceived as “serious engineers”, women have felt the need to strip emotional expression from their repertoire, donning the attire and disposition of a detached technical expert (Faulkner 2009b). The notion that technical expertise and emotional expression cannot coexist together is a persistent gender bias in the field.

However, other gender ideologies that underlie workplace biases shift and change from decade to decade, year to year, day to day, even person to person. This makes workplace bias a tricky topic to research. There are simply so many alternative explanations for why women struggle in science and engineering that it is hard to keep them straight. I was explaining my research one day at a neighborhood block party to one of my neighbors who is a biology professor at a local university. He posited several of the usual justifications: women drop out to start families, women are not as good at handling conflict. But then he veered into the strange, asserting that women’s brains are physiologically different from men’s, citing a study that shows that women are more likely to become addicted to crack based on their brain chemistry. He then circled back to contemplating whether it is women’s essential nature to be obedient and avoid conflict due to their biochemical makeup. Bemused, I puzzled over this strange logic with my husband later. He remarked that everyone seems to have some strange, complex rationale why
women are not succeeding in science. This means that women engineers are constantly hearing strange arguments that are not always grounded in logic and fact, and don’t necessarily have the ability to defend themselves in the moment.

The nature of gender ideologies is to make inequalities appear as if they are natural, normal and justified. Erroneous confluations of biology and social behavior have resulted in enduring notions of women as “nurturers” due to their association with their childbearing role; meanwhile gendered logics that associate women with “nature” and the “domestic” realm underlie nearly every human social structure (Ortner 1972; Rosaldo and Lamphere 1974). Over the centuries, new facts and arguments are constructed to prop up pre-existing notions that women should naturally behave one way, and men should naturally behave another. Bourdieu (2001) calls this the “labor of eternalization” that perpetuates gender inequalities over time despite changing cultural contexts. For many of the women I spoke with, these shifting arguments make gender biases confusing and hard to identify. Women struggle with questions such as: “Is it because I’m young? Or because I’m Asian? Or inexperienced? Is it just a personality conflict? Does this person treat everyone badly? Is this just a one-time occurrence, or a pattern of bad interactions?” Several lines of defense must be systematically eliminated prior to positively identifying something as bias or discrimination. Similarly, in my analysis, I frequently find myself asking, “How much of this is just one person’s perspective of an interaction? Perhaps there was something else going on here that I don’t know about?”

I would argue that this is the perpetual position of women in engineering: they exist in a constant state of hearing arcane

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2 This is a common methodological concern in qualitative interviews, since researchers typically hear only one side of the story and are unable to ascertain the context in which it took place. In this study, I take care to treat such claims as reported claims and perceived discrimination. In studies of inequality, the perception of discrimination can be as important as its validation, in that it alters individuals’ interactions with others and their overall sense of belonging.
arguments for why they are less suited for engineering careers and then spend significant energy searching for additional facts and context that might verify or refute such claims or otherwise help them understand why they seem to be treated differently from their male coworkers.

This position is made more complicated in a multicultural setting, in which gender ideologies mix with racial and ethnic stereotypes to further blur the boundaries and confuse the arguments. Semiconductor engineering draws engineers from every continent. While companies make a genuine effort to be inclusive and welcoming of employees from all over the world, multiculturalism is a difficult balance to manage in everyday practice. Inside these companies, identity stereotypes circulate primarily based upon nation-of-origin. One participant colorfully described internal cultural groupings as “mafias”: the Chinese mafia, the Indian mafia, the Korean mafia. However, in practice, workplace identities are more complex, requiring consideration of additional factors such as religion, age, and length of time in the U.S. For example, Durriya (F, 29, India) grew up in India, but her family is Muslim, which has been an important line of demarcation from Hindus, who make up the majority of Indian employees at her company. Although religious discrimination tends to dissipate upon relocation to the U.S., the rising Hindu nationalist movement in India has heightened the conflict between Hindus and Muslims, which is increasingly apparent even in the U.S. Therefore, while she might find common ground with some in the “Indian mafia”, these networks may not be entirely open to her.

In addition, there is a sense of cultural alignment with national identities, even if one was not born there, or no longer lives there. Vidya is a second-generation Indian American – she identifies primarily as an American but can easily step across boundaries into Hindu circles. Her work experience in Germany also grants her access to European networks. Similarly, Kashif is
Iranian by birth but spent most of his life in France. “I am French,” he asserts, in both his work style and personal demeanor. In contrast, Christine was born in China but was adopted by Americans, given a new American name, and spent most of her life in Massachusetts. She feels more Irish-Catholic than Chinese and does not feel any special affinity with migrant engineers from China.

Interestingly, company cultures also produce distinct identities – the company you first worked for, or alternatively, the company you most identified with, aligns with a particular set of characteristics. The “IBM mafia” are ambitious, collaborative and envision themselves as a family who looks out for one another. The “Intel mafia”, by contrast, are technically rigorous, disciplined, and strict. Therefore, although the popular concept of a “mafia” in the semiconductor workplace typically refers to national identities, in this multicultural environment, there are multiple layers that allow for inclusions and exclusions along other lines of identity. In this milieu of intersecting identities, in which stereotypes proliferate depending upon one’s nation of origin, gender, company history, etc., it becomes quite complex to tease out the nature of discrimination one may or may not be experiencing.

The goal of this chapter, without necessarily passing judgment on whether discrimination has occurred, is to outline the shapes that discriminatory practices tend to take. I begin by outlining the normative description of an engineer, which I will show has been shifting to become more collaborative than in the past. I show that rather than a universal standard, this normative engineer has a national identity, performing an American style of engineering which takes a somewhat different form than in other places in the world. Once the normative standard has been mapped out, I will show some of the logical inconsistencies in how participants of different genders and nationalities are perceived in performing engineering identity. I will
highlight common exploitations of weakness at work, which are tied to gender and ethnic identity. And I will close with the experience of confusion many participants are left with, regarding how to tell whether you have been discriminated against, and why there are incentives to ignore such treatment, particularly for racial/ethnic discrimination.

The Shifting Nature of Engineering Identity

On one warm June evening, I was having dinner with Michelle (F, 44, Indonesia), who works as a process engineer, and her family. Her sixteen-year-old daughter, Irene, was trying to explain to her father, Daniel, why she feels disillusioned by a recent career fair in computer science. “The professors I met were all old men,” she stumbled, trying to articulate her feeling of discomfort. “Plus, I’m behind on coding. I mean, I’ve done a little bit of Java, but it’s kid stuff.” There are new games, she explains, designed for kindergarteners that use Java “blocks” to create their own games. She feels she will be hopelessly behind if she were to choose computer science as a career. Daniel, who is himself an IT manager, prods her gently, “Maybe there are women in other places, even if you didn’t see them at the panel. There are a lot of women who are getting into coding now.” Irene glances at me occasionally during the conversation, perhaps to verify that what she is saying is right, or maybe to seek my support.

I decided to jump in with a story about the history of coding in the U.S. The family was surprised to hear that coding used to be a job that was performed by women in the 1960s and 70s. The confusion on their faces lifts, however, when I explain that coding used to be considered a routine monotonous, administrative activity. Men determined what the codes needed to do, and then women translated it into computer language. It wasn’t until these functions become more complex that men began to recognize its power and began taking over these responsibilities. Seeing that I had a captive audience, I continued outlining an article I had
recently read (Ensmenger 2015) about MIT hacker culture and the way this “hacker” identity has become the prototypical engineer identity in the U.S. Essentially, early computer science students in the 1970s would lock themselves in the supercomputer centers overnight, bringing in fast food and challenging themselves to create new games and competitions. These students gained a reputation for being reclusive and competitive, and for having poor hygiene and social skills. Women were excluded from these spaces partially due to their occurrence late at night, and partially to their aversion to the dark, dirty rooms and hyper-competitive atmosphere. Ensmenger argues that these cultures at prestigious MIT and Stanford campuses created the “hacker” stereotypes that we associate with engineers today.

Irene nodded along, as if I was describing an atmosphere she was familiar with. Michelle jumped in, observing that due to their exclusion, women probably missed out on important networking opportunities. I confirm that indeed, Ensmenger mentions that the competitions during overnight computing sessions often became the basis for innovations in coding that emerged from these universities. Irene lamented that she was so far behind. In comparison to kids who will be learning coding from their childhood toys, she will be starting basically from scratch. Michelle and Daniel try to reassure Irene. They didn’t know how to code when they were her age, and they were able to learn in college. While I wanted to encourage Irene to try anyway and tell her that there is always time to catch up, I also know that the bar for coding is constantly being raised as technology develops at a rapid pace. Another of my participants was discouraged from computer science for exactly this reason – she ended up finding a home in semiconductor engineering and computational mathematics, but the computer scientist kids were light years ahead of her simple coding skills by the time she went to college.
The concept of technical skill and engineering identity is central to many discussions of why women are underrepresented in engineering. McIlwee and Robinson’s (1992) pioneering work identified the importance of technological competence as a crucial factor in engineers’ success. Engineers must not only possess technical skills but must demonstrate passion for technological progress. In contrast, McIlwee and Robinson argue that women engineers are much more practical in their goals. They are less inclined to “tinker”, and less devoted to technology for technology’s sake. Anthropologists Tonso (1998) and Faulkner (2009a) bring greater complexity to discussions of engineering identity, arguing that there is a wide range of acceptable masculine identities in engineering. Tonso’s college engineering students divide themselves into three categories: the privileged Greeks, the stellar Academic Achievers, and the geeky Nerds. All three of these categories were associated with male students only – women were either “deficiently women” or “deficiently engineer”. Faulkner’s observations amongst engineering professionals revealed masculine identity categories such as “nuts and bolts”, “blunt and confrontational”, “football and families”, and “genteel and respectful” (Faulkner 2009a:7). Marginal masculine identities included “pranksters”, “macho men” and “shy men” (Faulkner 2009a:14). Faulkner notes that women’s performance of normative engineering identities is perceived as incongruous, particularly due to engineers’ tendency to revert to technical/social dualisms, with “technical” mapping onto men, and “social” mapping onto women. Women have to do extra identity work, Faulkner argues, to be seen as both “real women” and “real engineers” (Faulkner 2009b).

However, the image of engineers as technologically brilliant, antisocial, nerdy men is evolving. In the 1980s, corporations began to complain of Cold-War Era engineers’ inability to communicate, demanding that academic institutions redesign their curriculum to produce
engineers that had both technical and communication skills. Companies are beginning to look for what engineers commonly call “soft” skills, such as organization, communication, and leadership. Although organizational and communication skills tend to be associated with women, they are nonetheless becoming requirements of the engineering workplace. Samantha (F, 27, White American), a young industrial engineer, took issue with the perception that a “real engineer” was someone with “hard” technical skills only.

“So I would say the old stereotype of an engineer is male, I definitely see it as a male…They’re good at their skill set, they’re good at math, they can do the calculations, they’re smart. They may do some extracurricular stuff, but they’re not super athletic or looking for large groups of people to have big group events. But they’re quiet. They’re nice, they’re just quiet. And a lot of times it’s older men. My stereotype has shifted to a younger white male. What I think it’s shifting to…(sigh)...it’s going to take a while to get there. It’s shifting more to being a team player, having a skill set that includes being able to communicate well with others. But also being creative, that’s one of the biggest shifts in the engineering - who is an engineer. …There are times when I’m like, am I a real engineer? And it’s like, no yeah, you are a real engineer. You did all the basic stuff. I did all the math and everything like that. And I think that REAL engineer is based on an old perception of what an engineer has to be. It’s not valid anymore in today’s industry. Is it ‘soft’ engineering? Or engineers of the future? Depends who you’re talking to.”

Indeed, the technical/social dualism that was so prevalent in McIlwee and Robinson (1992), Tonso (1998), Faulkner’s (2009a) research appears to be breaking down as the 21st century progresses. When I asked Michelle and Daniel whether women were perceived to be less skilled at “technical” work, they seemed genuinely confused. “Not at all,” Daniel says. “Engineering is getting better for women because it is not as much physical work. It is mental work. Women might be at a disadvantage in physical, mechanical work because they are weaker, but mental work they can do just the same.” Michelle agrees. She feels that her technical skills have never been under question at work. I tested this hypothesis on several other semiconductor engineers, and each time it was met with similar confusion. While most agree that there is still gender bias
in the workplace, it does not necessarily take the form of questioning women’s technical capabilities, at least in this industry.

I believe this is partially due to the nature of semiconductor work as a “high tech” industry, and partially due to change over time. McIlwee and Robinson (1992) specifically note the distinctions between “high tech” and “old tech” cultures in engineering, with “high tech” having less “hands on” work, greater autonomy, and higher technical prestige (1992:105). However, McIlwee notes that even in “high tech” culture, the “technical brotherhood” (1992:114) was still prevalent at the time of her research. Therefore, I believe there is evidence of an evolution of the field over time. While it may still be the case that in “old tech” fields with more “hands-on” work and heavy machinery women are still perceived to have fewer technical abilities, in “high tech”, with its emphasis on mental work, women have a better shot at their technical skills being evaluated on equal footing with men.

However, although women have demonstrated their capacity for technical skill, they are still perceived to be masters of “social” skills in relation to men. Given corporate emphasis on communication and organization, this appears to be a positive association that might give women an advantage in climbing the corporate ladder. Nonetheless, it demonstrates that the technical/social dichotomy continues to resonate. Although women are making progress in showing they can do both, they are still seen as essentially social beings. This generates dissonance when women prefer to stay in technical roles yet get funneled into management and organizational roles despite their protestations (more on this in Chapter 5.)

In addition, the new engineer identity is, as yet, a contested form. Some men in the field still assert their authority along the lines of “tinkering” and “hands on” work. It is present in stories like Samantha’s where in comparing herself to the “old engineers”, she wonders, “Am I a
REAL engineer?” Similarly, Christine (F, 23, Chinese American), another young graduate hired directly out of her bachelor’s degree program conveys her frustration and bemusement at a manager who was obsessed with tools and cars. She came to semiconductors with neither interest nor ability in these areas, and felt they were entirely irrelevant to her work. Yet her manager believed an integral knowledge of machinery was essential, and continuously complained about his predecessor hiring so many new college graduates for positions he felt required more experience. He grilled the two young girls on his team about the inner workings of the tools they managed. Christine felt blindsided.

“It was like [my coworkers] were speaking a different language… So my mentality was, I’m just gonna start from zero. So I can get full training on everything. I’m going to take his expectations and exceed them. I said that to myself. I didn’t say that to him. But knowing how to use a screw driver, how to use allen wrenches, that was not important for this job. It was communicating with people. It was talking to vendors. It was understanding, yes it was understanding how the tool is set up. Not how to take it apart. Like the stuff he was talking about was not as important.”

Christine has embraced the “new engineer” identity, with its focus on communication and interpersonal work. Her boss, on the other hand, was still very entrenched in the old engineering identity, a view that privileges mechanical knowledge and tinkering, in which if you don’t know the ins and outs of your machine, you are doomed to failure. Although this appears to be an outlier experience in semiconductors, it does show the impact that such outliers have on women’s success. Christine and her female coworker left semiconductors and high-tailed it to the biomedical industry as fast as they could.

Furthermore, in addition to these well-trodden lines of defense, new binaries have emerged that position men over women. In what other scholars have called “boundary heightening” (Faulkner 2009b; Pierce 1996; Kanter 1993), new ways of organizing, valuing and ranking tasks at work continually position men and masculinity at the top. Similar to my
disorienting conversation with my neighbor, who organized gender according to conflict and obedience, these dichotomies are at once familiar and strange. In the shifting sands of changing perceptions of gender at work, these dichotomies evoke familiar gender ideologies but have not yet solidified in the social consciousness to the point where they are recognized and agreed upon by everyone. In my work in semiconductors, some dichotomies were widely recognized, and others less so. The separation between physical work and mental work, as Daniel mentioned, was one that I heard several times. Women are still perceived to be not as strong as men, and therefore less capable of mechanical work. This is not perceived to be a disadvantage in semiconductors, where mental work is more prevalent, but it may contribute to the marginalization of women in other disciplines of engineering, such as mechanical, industrial, or heavy manufacturing. Less commonly repeated was a perception that women tended to do better with memorization and routine work, while men were better suited for complex, analytical work. This idea echoes common labor dichotomies in which women are associated with routine, monotonous, cyclical tasks, while men perform linear projects that benefit society (Rosaldo and Lamphere 1974; Bourdieu 2001). Another I heard less frequently was the valuation of physics backgrounds over chemistry backgrounds. Although chemistry forms the “base” of many semiconductor processes, it is characterized as routine work, whereas the exciting work takes place on the physics and engineering side of the process. The fact that women are better represented in chemistry and chemical engineering programs than physics or electrical engineering again positions women at a disadvantage. I see these new dichotomies as a testing ground for future justifications of gender inequality. While they have not yet taken hold, they may eventually solidify into a formal rationale that protects male dominance of the field.
For their part, women seem to relish the emergence of the new engineering identity. Many fully understand the pitfalls of being seen as “social” rather than “technical” and work hard to demonstrate that they can indeed do the technical work. But the growing importance of communication, collaboration and interpersonal skills in the workplace has led to the emergence of a new kind of engineer that they can embody better than their male colleagues. Michelle (F, 44, Indonesia) has leaned into her collaboration skills as a justification for why she is an integral member of her team. Although she is a newcomer to her current group, multiple people have already sought her out as a facilitator for collaboration between teams – even on projects her team is not directly involved in.

“I make sure the communication goes smoothly and that it gets translated from one discipline to another. Sometimes people don’t like to communicate as frequently as they need to, or they don’t realize that others don’t have the right information. I am good at solving those communication problems.”

Emily (F, 34, White American) also resonates with this collaborative type of engineer, arguing that her role in her group is to be the social glue that holds the team together.

“I could…use [being a woman] to my advantage in certain ways? Like being one of the people who was ‘diverse’ in the group…and diverse in a way that I was more social…I would create groups and study groups and branch out more. Where they would go off on their own a lot, but I could be the glue in this situation? I think I used that to my advantage in a lot of these different research areas. I’ve been more social, somebody who wants to draw people in and chat and be more humanizing.”

The new definition of engineering identity makes her work feel more humane and less isolated.

Samantha (F, 27, White American) likes the opportunity to define a new generation of engineers:

“The year after I graduated, [my university began] this interdisciplinary program. It brings the engineers to classes that are more design based, or artistic, creative stuff. Bringing in entrepreneurship, things like that. Being an engineer is shifting. We’re definitely getting to be cooler. (laughs) It’s shifting from being male to being bold.”
Women’s role in the new engineering identity is still a hotly contested space. The nature of the contest seems to be between the desires of management, who strongly prefer interpersonal skills, and the desires of engineering peers, who are still deeply divided on the subject, by gender, discipline, and generation. It is unclear whether and how the new engineering identity will win out over the old, and whether women will maintain their position as better communicators once the new identity has solidified.

**Doing Engineering, the American Way**

Throwing another layer of complexity into the mix, it becomes clear upon speaking with migrant engineers that the “new engineering identity” I described in the previous section is a profoundly American way of doing business. Cultural differences in engineering were revealed primarily through participants’ comparisons between their workplaces in multiple locations. Some participants felt favorably toward the American style of business, preferring to work in the U.S. than in other parts of the world. On the other hand, several of my participants expressed a deep dissatisfaction with the American style of engineering. Although these complaints might be dismissed as anecdotal remarks, Sara Ahmed (2021) writes about complaint as a tool of resistance, a “weapon of the weak” (Scott 2008). Therefore, I prefer to treat these complaints as fissure sites, in which migrant engineers are attempting to work through fundamental issues of identity and assimilation.

Engineers who felt favorably toward the American style of engineering attributed it to the shorter work hours and better benefits in comparison to other places they had worked previously. Particularly in comparison to Asian companies, American companies work fewer hours, have clearly delineated weekends and vacation time, and experience less stress in their day to day lives. Devayan (M, 46, Malaysia) says he was warned not to go into semiconductors in
Singapore because it was a “pressure cooker”. He worked extremely long hours, was routinely called in the middle of the night, and experienced a great deal of pressure to meet high efficiency and productivity goals. “American workers wouldn’t take it,” he tells me, matter-of-factly, on multiple occasions. Adam (M, 47, Malaysia), who also began his career in Singapore, agrees. “Everyone works around the clock,” he tells me. “You are on call all hours of the night.” He prefers the U.S. due to the country’s entrepreneurial spirit.

However, engineers who have worked in Germany are quick to point out that German work hours and benefits far surpass those existing in the U.S. Healthcare, paid leave, and strictly enforced weekends and time off differentiate the German work experience. Raphael (M, 45, France) tells me, “If you send an email over the weekend, Germans will pretend they did not even see it. And as a manager you’re not supposed to ask. You can’t even ask! You’re not supposed to do anything negative if someone is not answering your email over the weekend.”

Raphael is well-versed in complaint. “Complaint is a national sport in France. You just complain a little so the guy next time will pay attention.” Raphael has a PhD in physics and a gift for comedic timing. He loves a captive audience, and I get the feeling that he would likely tell stories and crack jokes for as long as I cared to listen. I am using his voice prominently in this section, partially because I think he will not mind, and partially to help mask the identities of others’ complaints.

Raphael is quite critical of the communicative style of American engineering. He views this as a privileging of communication over technical skill.

“[American engineers] are technically very low, the level is very low. I don’t know if it’s from the universities, or the way the courses are done in physics schools. I’m not sure more than half of them know why the sky is blue, this level of theoretical physics. And you see that at work.”
To illustrate this point, Raphael tells a story of an expert giving a presentation to a team at his workplace. In the Powerpoint presentation, Raphael noticed there was a zero missing in one of the expert’s figures. “There was a factor 10 error! These two values usually are the same order of magnitude!” When I inquired whether this might have been just a typo, Raphael brushes this off. The order of magnitude should have made it very noticeable, he said. Someone on his team should have seen that the number was wrong and corrected it. He jokes that perhaps someone was sabotaging the expert, putting in wrong numbers and making him look like a fool.

He was further disturbed that of the other 80 engineers in the room, he was the only one who noticed that the figure was wrong. “I was the only guy of the 80, looking left and right, nobody was reacting…Nobody in the room had any idea what [he] was talking about. Or was paying attention to what he was doing.” Raphael sees this as evidence that American engineers are not attentive to detail and do not fully understand the relationship between numbers on a page and what they mean in the physical world. This is a heavy blow to level at American engineers, but let’s consider his point for a moment.

Instead of technical ability, he argues, Americans put a high priority upon presentation skills and interpersonal communication. This does indeed resonate with many other accounts of the work environment in semiconductors. In Europe, Raphael claims, managers and coworkers do not care at all about presentation skills.

“In Germany, the guy even if he’s old and he speaks slowly and he’s shy and you cannot hear half of what he says. The guy will be the best! He’s the best on the subject! And he will help your job. In the U.S., the same guy, they will put him in a little closet…The way you present, who cares? [In Germany], no one will value that in the meaning of your presentation. In the U.S., we care whether we believe you or not. [Incredulously:] It’s data! What are you not believing?!”

Raphael also critiques the inefficiencies that result from an overemphasis on communication. Because so much of their time is spent communicating in meetings and
conference calls, employees regularly multitask by doing their own work while sitting in meetings. Of the 80 people present in the meeting he described, half were on their computers and not paying attention. This common cultural practice is corroborated by many of my participants. Wangshu (F, 38, China) laughs as she describes her afternoon conference calls, eating lunch at her desk with her headphones on, half-listening to the call, but mostly using the time to multitask, doing her own work. When someone asks her a question, she is sometimes startled and has to ask, “Wait, what did you say?” Things like this annoy Raphael.

“More and more in Germany, there are meetings where the computer is forbidden. In France, if the guy opens his computer in the middle of the meeting, you can scream at his head. And say, ‘Guy, if you’re not interested in the subject, go back to your office.’ Beem! I’ve done that in a meeting in France.”

This would not be appropriate in the U.S., as Raphael understands. He has learned to temper his tone.

“I have to ‘Psst’ him, say his name, take his attention back out of his computer so he looks at what I’m presenting to him. I have to say his name, so he ‘Uhh?’ wakes up, then present again the same slide to the guy and ask again the same sentence. I’m French, I HATE to repeat myself two times. [Sometimes] it happens four times in the same meeting.”

This inability to provide blunt critique in the U.S. grates on Raphael. In the American workplace, politeness is critical. While it is one thing to be polite about coworkers not paying attention in meetings, Raphael believes this also exposes crucial problems with risk management in the American system. In France, he explains, there was a phrase, “the shit of the last minute”, *la merde de la dernière minute*, which everyone collectively recognized as something that required forethought, planning, and time. It was believed that it was better to bluntly point out problems and expect delays than to reach the project deadline and realize you had made critical errors. Americans, by contrast, are “blindly positive” according to Raphael, and problems have to be pointed out carefully and politely.
“In the US company I’m working in, it’s a big issue. They see issues every day that they have never imagined because they were sure everything was going to work perfectly. And if someone comes to them and says, ‘Hey guys, wait wait wait. There is a risk, somebody has to check that.’ They will consider him as a negative and a person that is not doing a team work. That is a huge problem. A big problem! The guys have no idea about the risk of their project and their task. They don’t care about the risks because oh, that’s such a negative vibe…you become a problem person.”

Furthermore, decision making in American companies is much more collaborative, with most decisions achieved via consensus. Several of my participants who worked in Europe note that American management styles are much more flexible. Roles are not as clearly defined as they would be in Europe, allowing employees greater latitude to expand their skills, yet also leading to confusion over what specifically their job is, and what is out of their wheelhouse. Lucas (M, 35, France) laments that as a part of his role in the U.S., he has had to figure out basic marketing skills, how to present to customers, how to design chips that will be profitable. In Germany, he claims, he would be focusing primarily on the design work, while letting the marketing professionals handle client needs. Furthermore, engineers are expected to contribute much more to decision making than in other management styles. As opposed to more rigid hierarchies in Germany, in which the managers make the decisions independently, in the U.S. the decision-making style is to collect the opinions of as many people as possible before the manager decides the best path forward. Wangshu (F, 38, China), who worked in China in her early career, says she was surprised when she came to the U.S. that her opinion was sought by her managers. Asian managers, she explains, have a more autonomous leadership style. Employees in China are not expected to speak up about their own opinions or question their manager’s judgment. This places more pressure on the manager because he must have a high level of knowledge about all the systems that interact with his team’s responsibilities. The employees in this system simply execute the tasks that he assigns. Part of Wangshu’s learning curve in the U.S. has been learning
how and when to speak up in meetings to offer her opinion. For Raphael, whose French
total background has conditioned him to offer strong opinions, he sees the American system
differently. “They will ask for your opinion, but they will not listen to it,” he says. His
experience of offering cautionary advice and having it ignored leads him to the conclusion that
the American system likes to be seen as collaborative, but in reality, the managers will prioritize
profit over risk regardless.

Raphael connects these differences in workplace culture to a larger problem with
efficiency in the American work style. From emphasizing communication over technical data, to
excessive multitasking during meetings, to poor risk management, to collaborative decision
making, American engineers are characterized as prioritizing communication over technical
output. These critiques may be dismissed as unfair, ungrounded, or the opinion of one person
amongst the many. It is also worth noting that workplace culture varies widely between
companies. One company in the area has a reputation for being highly collaborative, another for
its far-sighted long-term vision, another for its commitment to technical excellence. Therefore, it
is unfair to apply these critiques equally to all American workplaces. However, I appreciate
Raphael’s sentiments insofar as they grant us a lens through which to view the American system
of engineering. The goal of anthropology is, after all, to make the familiar strange, and through
Raphael’s eyes, the American system becomes less logical. It enables those of us who have been
embedded in the American way of working to imagine how things might be done differently.
Raphael takes most of this in stride, masking his criticisms with a joking demeanor. He appears
unaffected by the strain of adapting to this unfamiliar environment, and immune to the risk of
becoming a “problem person”. It is a role he accepts and wears with pride and little fear.
However, for many migrant engineers, becoming a “problem person” is terrifying – “problem
people” lose their jobs, their visa status, have their world upended. Gaining cultural competence in the American workplace is therefore a matter of urgent importance.

**Inequalities in the American Engineering System**

Adjusting to the expectations of the American workplace requires significant effort and confuses the lines of discriminatory behavior at work. Is it discrimination? Or just cultural differences? In this section, I want to open a discussion of how the battle over how much or how little communication is privileged in the American system maps onto gender and racial inequalities. As previously shown, the increasing demand for more communication skills has given American women an edge; the existence of a “new engineer” identity has become a new way to define themselves as a critical part of the engineering workforce. However, at the same time as “old engineer” devotees wield arguments about technical skill against women, communication and collaboration are wielded as a tool of exclusion against migrant engineers. Therefore, as American women capitalize on communication as a way to increase their power, they risk stepping on non-Americans on their way to the top. Meanwhile, migrant engineers who struggle with communication wage a war on the opposing side, arguing that technical requirements are the only thing that should matter.

To give a sense of how this works, I will outline a conversation I had with Vidya (F, 44, Indian American), who is the very embodiment of the “new engineer” identity. Now a manager herself, she is empowered to mentor and promote people she feels are deserving, a responsibility she takes very seriously. From Vidya’s perspective, having technical ability is “table stakes” – a baseline capability that all engineers are expected to possess. Everyone in this industry is smart, she says, so that is just expected. In addition to technical skills, she is looking for someone who is responsible and has good interpersonal skills. In addition, they should know how to “talk up”.
This is a political skill – knowing how to speak to your superiors with an understanding of how this differs from the way you would talk to your peers. It also encompasses an ability to use corporate lingo and to frame your ideas in a way that highlights the benefit of your idea to the company. This is an incredibly difficult task, even for an American engineer who grew up in this system. Most of the “old engineers” would not survive such a test and would be relegated to lower ranks of the company. Vidya understands that this is hard, but she wants to keep the standards high. She also believes this is something you can teach through good mentorship of the right people. She keeps a list of “high potentials”, employees she is keeping an eye on, most of them young women, hoping there will be an opportunity to recommend them for leadership positions.

The bar to be considered a “high potential” is particularly high for migrant engineers adjusting to American ways of working. Migrant engineers may struggle with English if it is not their first language, making the task of communication, let alone persuasion, more difficult. Enofe (M, 35, Nigeria) experienced this difficulty in Germany. He was very proficient English, having learned it when he was young; however, his coworkers were more comfortable with German.

“In meetings they would throw out the question, ‘German or English?’ It can be difficult when you have meetings in German. Because you do a lot of translation. And then there are words that are ambiguous, terms, engineering terms that you would not necessarily learn when you’re learning a language.”

In this segment, Enofe makes an important point that engineering terminology and corporate lingo adds a layer of complexity to language fluency, since these are not covered in standard language courses, making communication especially difficult. He had a hard time keeping up with the conversation in meetings that were conducted in German, and yet he also didn’t want to be the one to request that it be conducted in English.
“I don’t like to deter the work. I see that communication for most [German] people in English is VERY difficult. They have a group of people who want to solve a problem and you are the only foreigner there and because of that you need them to communicate in English. You can’t even communicate their ideas, so the work is slower and all that. It’s difficult…So you’d rather say ‘Oh no, German is fine.’ And then you have to battle and try to make sense of what they’re saying.”

For Chinese-speakers, the language barrier makes them particularly vulnerable to exclusions based on communication abilities. While German and English share some linguistic features, Chinese and English belong to completely different language families. Some Chinese speakers feel very self-conscious about their language abilities after having been told by managers and coworkers that they were difficult to understand. Indeed, Xiaoli (F, 35, China) was hesitant at first to be interviewed for this study since her husband teased that I might not be able to understand her. In my experience, most Chinese engineers who came to the U.S. spoke very good English; although I sometimes needed to ask someone to repeat a phrase, we were able to work it out fairly easily. Still, many of my participants, both Chinese and non-Chinese, have remarked upon communication between Chinese speakers and English speakers as a significant hurdle.

In addition to the language spoken, an employee’s communication style is prone to misinterpretation. Anna (F, 32, Bulgaria) was frustrated by her American manager’s characterization of her style as “too European”. Her early work experience had trained her that it was a basic courtesy to place a phone call before arriving at someone’s office. In a previous job in Belgium, she learned that people did not like to be interrupted by unexpected office visits. “The phone would ring and ring and ring off the hook if they did not want to be interrupted. If you show up at someone’s door unannounced, they will slam the door in your face!” she exclaims. She came to feel that calling before arriving was a more polite way to work. Her
American manager, on the other hand, felt that calling before arriving was superfluous and inefficient. He expected her to just drop by when she needed something and urged her to assimilate better to the American style of communication. However, his dismissal of what she felt was a common courtesy as “too European” angered Anna. While she had indeed picked up this habit in Europe, it was not the case that all Europeans behaved in this way. In fact, in her home country of Bulgaria, people were in the habit of dropping by at any moment and staying to chat for hours, a habit that would be considered very rude in the U.S. She felt that she had already significantly altered her behavior to be more polite and was upset to have her efforts dismissed. She felt that misunderstandings regarding how she communicated, aside from what was communicated, damaged her relationship with her manager and inhibited his recognition of her as a “high potential” employee.

Furthermore, the United States appears to be something of an anomaly in the world in their emphasis on presentation skills in early education. American children practice communication skills from very early ages, through book reports, group projects, science fairs, class presentations, and other school activities. By the time they graduate from high school, American youth – even presumably socially awkward engineers – know how to deliver a Powerpoint presentation. Presentation and public speaking skills are further refined in higher education. By the time students enter the workforce, they have had years of practice. This type of education seems to be absent from many other places in the world, contributing to migrant engineers’ confusion when so much value is placed upon public presentation skill and style in the American workplace. Raphael’s frequent critique “Who cares!” is echoed by many migrant engineers. And yet, in American engineering, managers care, further contributing to perceptions that migrant engineers lack communication skills.
I’d like to return to Vidya’s evaluation of “talking up” as a critical component of “high potential” engineers and highlight the difficulties of this requirement for foreign engineers. “Talking up” has two major components: (1) speaking to supervisors in a favorable way, and (2) persuading supervisors that your ideas are good for the company. On the first point, speaking to supervisors at all is a fraught task for engineers from outside the U.S. Chen (F, 28, China) understands the importance of having conversations and mentorships with managers at higher levels, but feels that Chinese employees in particular struggle to make these connections. One of the ways employees find mentorships is by networking at company social events, but these informal conversations can be hard to sustain between Chinese and American employees. “I could never make small talk with an American,” she says. “You walk up and ask where someone is from, they say New Jersey, and I don’t know where New Jersey is or anything about it.” Reciprocally, Americans would not know where her home state of Guangdong is located, or anything about it either. Chen would be lucky if they knew where Beijing or Shanghai were on a map. This is just scratching the surface of forming strong interpersonal relationships that lead to professional success.

Furthermore, there is considerable difference of opinion on what kinds of arguments employees and managers find persuasive. In Vidya’s description, a persuasive argument positions your idea in terms of the company’s profitability. This requires a deep understanding of the company’s portfolio of projects and operations, and a knowledge of how your team’s project contributes to the company’s profits. At lower levels, it may be more difficult to see with this perspective. In addition, as Raphael’s narrative shows, employees have different opinions on how to achieve higher efficiency and profitability – is it through completing projects rapidly or through more effectively evaluating risk? Through better communication or higher technical
expertise? It is not necessarily that one quality must be sacrificed in favor of the other, but that people value things differently.

Furthermore, the style of persuasion is another point of misunderstanding. While in France, as Raphael points out, conflict is resolved openly and bluntly, in the U.S., one is expected to be more polite and allow the other party to save face in front of a group.

“In France EVERYBODY will be finger pointing! Scream at you! At each level of the hierarchy! And the other teams, even two years after, they will point to the mistake you did two years before. So you don’t want to be the guy that can be finger pointed in France. That’s why you want to be super cautious...In the U.S., there will be a public demonstration, very polite, very gentle public demonstration of who did mistake. But it will be public. It will be communicated. In Germany, it will not be communicated, it will be diluted. You will use the word ‘we’. ‘We have seen an issue.’ In the U.S., no. They will finger point. They will say which team did the mistake. But they will be gentle in the way they finger point.”

Raphael describes how he has learned to use new kinds of persuasion in his new American team. On his team, they have just had a deadline pushed from March to July, but he wants to save some time at the end for “the shit of the last minute”, so he has asked for teams to complete their work by June.

“The guy is pushing me why I am asking [for these deliverables] in June and not in July. Are you serious? That’s the work you were supposed to do in March! Okay? So I also have to find a good reason for the early delivery. [A reason] that is positive. I cannot say to him, ‘Because I think you will do a shitty job and delay to deliver your stuff.’ That would be negative and not a teamwork. I have to give him a good excuse. So I find an excuse, ‘Yes we need some time for administrative and for pre-review.’ It’s working, okay?”

Stories from Raphael, Enofe, Anna, and Chen illustrate some of the difficulties that migrant engineers face when trying to compete in the American “new engineer” communication-focused arena. While migrant engineers from most backgrounds struggle on this front, Chinese engineers seem to have it particularly hard. Language and cultural gaps between Asian and American engineers make it difficult for Chinese engineers to understand and be understood by
their colleagues (Gu 2016:126). As a result, Chinese engineers tend to keep to themselves more than other groups, and are often relegated to the most routine, technical tasks. Although this is justified by their managers as due to poor communication, I hope we can now reframe this as significant misunderstandings across language barriers, leadership styles, and communication styles.

It is perhaps unsurprising that Chen and many of her Chinese coworkers feel strongly that technical capabilities should be the most important factor.

“The Chinese engineers you see here are almost the best students. They are the best. It’s like - the Ivy League people…The average level of my own circle is actually higher than the circles here…We, the Chinese community in America, always compare ourselves with Indian people. We realize technically we are way much better, but interpersonal ability, much worse. That’s why CEO or high-level managers, you barely see any Chinese. One or two. But Indian people whoop! [makes an upward gesture with her hand]. Quite a lot. That’s why.”

Chen is engaged in the midst of a struggle for recognition of her technical expertise, while carefully navigating the fraught world of American style communication. When I ask whether she feels that she is able to communicate her skills clearly to her colleagues, she says this is more a matter of style:

“Actually, [my language is] clear enough, but just more direct. [Americans] like wiggling, they know how to play with language. We’re foreigners, we just directly pinpoint the problem. Maybe it’s not fancy enough. I call it ‘marketing strategy.’”

It becomes clear after hearing from migrant engineers that the American style of engineering is distinct in its emphasis on communication and interpersonal skills over technical skills. Migrant engineers are at a disadvantage to American-educated engineers on this front, and therefore, tend to be dissatisfied with the American style of work. This positions them in opposition to the gateways that communication skills open for women in engineering. For women migrants, this is especially complex.
Communicating Emotion: Gendered Feeling Rules at Work

In addition to communicating technical concepts, engineers must also learn how much, and how little, emotion to communicate at work, and how to communicate it. Scholars of language and work have argued that emotions are a facet of communication that must be carefully managed in the workplace. Hochschild’s seminal work frames “emotional labor” as critical work that is done by flight attendants in producing customers’ feelings of satisfaction by carefully inducing or suppressing their own emotions (Hochschild 2012). As studies of women in male-dominated fields have extensively documented, women and men operate under different sets of guidelines when communicating emotions at work (Tannen 1994; Pierce 1996). In her early work, Tannen’s (1994) linguistic analysis of women and men’s conversations in the workplace revealed numerous facets of gendered communication styles, including women’s proclivity (and expectation) for apologizing and using indirect, rather than direct, forms of conflict resolution. Her later work clarified that although there are ways of speaking that are culturally defined as masculine and feminine, both men and women use both styles, depending on their level of authority in the workplace (Tannen 1999). In her study of female litigators, Pierce (1996) similarly discovered that women’s aggression in the courtroom was interpreted negatively by jurors, leading some women to change their litigation style to demonstrate more caring and compassion. Wingfield (2010) demonstrates that “feeling rules” are also racialized, wherein Black women feel unable to express emotions such as anger and frustration in the workplace. There are also ethnically-informed feeling rules, such as those described in Shan’s (2012) study of Chinese engineers. In contrast to American self-promotion and individualism, Shan finds that Chinese and Asian values dictate that workers demonstrate greater relational reflexivity, though humility and allowing others to “save face”. In the world of semiconductor
engineering, my fieldnotes are filled with examples of men’s anger at work, expressed openly and sometimes harshly. In contrast, women’s expressions of anger are not tolerated in the same way, and they are constrained by a stricter mandate of “niceness”. Finally, expression of emotions is mediated by race as well as gender, and Asian women must strike an altogether different balance of emotion than white women.

A certain level of open conflict is an expected component of American engineering workplaces. For women entering the field, this can come as a surprise. Emily (F, 34, White American) describes her experiences in grad school as a crash course in receiving harsh feedback from her colleagues:

“You are supposed to be able to just really fight about this stuff. But then just get over it. And I wasn’t at all used to that. I was affected by that for a long time after…People would look at my work and pick it apart. And in a very critical way. Very abrasive. That back and forth was something that was expected [by everyone].”

The ability to openly confront and fight with others and then quickly move on is a familiar form of masculine conflict resolution. Tannen (1994) identifies a masculine speaking style, in which conflict is used as a way to achieve a higher status. Tannen refers to this style as a “one-up / one-down” dynamic, in which the speaker strives to avoid being placed in an inferior “one-down” position in relation to others. In contrast, she observes a feminine speech pattern which utilizes communication to preserve intimacy and harmony. Within this desire to maintain harmony, conflict is addressed indirectly, through tactics like gossip or the cold shoulder.

Through processes of socialization, men are socialized into masculine speech patterns and women into feminine ones, although Tannen herself clarifies that both men and women can and do use both styles, depending upon context and level of authority (Tannen 1999). Tannen argues

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3 Such distinctions are important because they refute essentialist notions that women are “naturally” inclined toward harmony or are biologically driven to preserve intimacy and emotional connection. Anthropological cross-cultural
that for those who use communication for the purpose of forging intimacy, if outright conflict occurs, the rift in the relationship takes time to heal. It is incongruous for those who prefer a harmonious communication style to view such a rift as something that they could “just get over” as Emily points out. However, for those who are well-versed in the “one-up / one-down” conversation style, this is not viewed as a breach of intimacy but a temporary victory in “one-up” positioning; they expect to be challenged again in the near future and it does not fundamentally damage their relationships. This style of abrasiveness is common in engineering wherein engineers routinely argue with others as a method of persuasion or simply to express their dissatisfaction.

One evening over dinner, Devayan (M, 46, Malaysia) describes a conflict he had at work the day before in which he yelled at another man for slowing down the process. He had been called into work in the middle of the night and was trying to troubleshoot a problem in the fab. These are always high-pressure scenarios, since every minute the fab is down results in millions of dollars in losses, so everyone understands the need to work quickly. On this night, one man was constantly questioning his plans, trying to make sure Devayan was thinking through every possible risk. Devayan was offended that the man thought he did not know the system and considered this line of questioning unnecessary. “I was quite rude,” he says to me in a conciliatory way. His boss told him he was too harsh and set up a meeting for the two of them to smooth it over the next day. Neither man apologized, but they did shake hands and the other man acknowledged that he had been at least partially in the wrong. They never spoke of it again.

Emily feels this type of interaction is pretty standard in her field, particularly due to the pressure related to developing new technologies with such a slim margin for error:

comparisons have demonstrated that there are a wide variety of behavioral expectations by gender (Mead 1935; Ortner 1972; Rosaldo and Lamphere 1974).
“The culture can be very argumentative. It was a struggling technology too, so you have to take that into account as well. Everybody was trying to get it to work and it’s very frustrating...A lot of work was going in and not a lot of recognition was coming out. So it was an unmotivated environment, or like hyper-motivated, or just motivated by ‘Okay I just don’t wanna be under the spotlight in a bad way again today.’ It’s really volatile and argumentative.”

Things are not always smoothed over afterward as they were in Devayan’s case. Carmen (F, 37, Puerto Rico) was surprised and offended when her boss openly yelled at her in front of her coworkers. Startled by this, I ask to confirm, “He would actually yell? In front of others?”

“Oh, not just me!” she exclaims. “Everyone else too. He was very equal on that front.”

Nihal (M, 47, India), an Indian manager, also confirms the commonplace nature of this behavior. “Sometimes I will have to tell them ‘You – follow the process!’ They will scream, they will yell at you.”

Again, surprised, I confirm, “They actually yell?”

“Yes, yes,” he says almost dismissively. “You have to tell them ‘Listen, this process is in place for this reason.’”

The ability to yell at work seems to be something that only men can do. Anger is an emotion that is gendered masculine; women’s anger is almost always perceived as inappropriate, out of line, or overly emotional. I have only one account of a woman yelling at work and it occurred in a private setting, not in front of others. Although women routinely experience feelings of anger, it tends to be sublimated and then twisted until it can be expressed as some other kind of emotion. In my research, I frequently heard women’s anger expressed instead in the form of anxiety, or sometimes sadness. Even with these more limited expressions, women’s emotions are frequently misinterpreted by their male colleagues.

When Emily (F, 34, White American) moved into a more difficult role at work, she experienced a significant amount of stress trying to perform the work that had previously been
conducted by three people. “People used to call me the busiest person at [the company],” she says. She found it hard to hide her anxiety from her coworkers.

“I was doing the best I could, also requesting and asking for help whenever I could. But if you put any more [emotional] energy into a situation, rather than just being like completely absent and like a computer, having any sort of emotional feedback is just not really tolerated. Especially, when I moved into my second group, they quickly used that against me. They’d like take away my work. ‘We don’t want anybody to be too stressed out. To be too overwhelmed. So we’ll take all of this from you.’ It was used as an excuse.”

Emily feels that she has to restrict the expression of emotion of any kind at work, including joy. She says she is “too bubbly” for the environment around her and feels she has to button herself up in her interactions at work. If she expresses any kind of anxiety at work, it is perceived as an emergency, or a problem that must be resolved, when sometimes she is just trying to blow off steam. She finds herself treading very carefully, making sure she has all of her facts straight, keeping a measured tone.

“Perfection is necessary, it feels like. Any small mistake tends to be amplified. Used against you. Maybe that’s a negative way to put it. But it feels like that sometimes. In their arsenal for why they shouldn’t be taking you seriously. That’s hard to, you know, it depends on the day, but sometimes you just feel like going in and getting your work done and not navigating that extra social pressure.”

Emily’s perfectionism is a defense mechanism against the frequent misunderstandings of her emotional expressions at work. Her emotions are interpreted as weakness and become another of the many shifting rationales that are used to undermine her at work. As a result, she tries to become “like a computer” in her interactions at work.

However, conflict is a relative experience, and from the perspective of foreign employees, Americans tend to be more polite in their interactions with others at work. As Raphael points out, in contrast with French work styles, there is considerably less yelling and less blunt critique in the U.S. This is corroborated by employees who have worked elsewhere in
the world. Devayan remarks to me that people are nicer in the U.S. than in Singapore and the UK. Everyone smiles at you. Enofe (M, 35, Nigeria) agrees, he experiences a lot less overt hostility as a Black man in the U.S. than he did in Germany. But there is also a perception that this “niceness” goes only skin deep. In the eyes of foreign engineers, this face-level politeness may be seen as superficial, or even fake. Indeed, Enofe confides that he struggles to connect with Americans, particularly American men.

“Americans are overfriendly on the outside, but to get into that core seat and be a trusted person, a trusted insider, it takes a long time. But they can be ‘hi hi’ everybody smiles and all that. It’s just so superficial.”

Lifen (F, 29, China) levels similar critiques, adding that it can be difficult to tell across cultures whether someone is being genuinely nice, or if they want something in exchange, or if they are just pretending:

“If I am talking with Chinese I can quickly figure out, what he really thinks, even though he pretends. But when I’m talking to American people I haven’t figured it out. I don’t know when they are saying good things if they are pretending or that’s the truth. If they are pretending to be nice or they are really nice.”

Furthermore, she feels that she is expected to “be nice” more than she feels is warranted. Her boss’s most frequent critique of her is “Lifen, be nice.”

“My husband is very calm. He will quietly work away. My manager describes this kind of calm as nice. If I’m becoming angry, I’m not a nice person. He keeps describing the emotional part as ‘Lifen, be nice.’ …I’m like what the heck? I can still be nice, who is not nice? How do you define nice? I’m confused by this word ‘nice.’”

She attributes this directive to her boss’s Korean cultural understandings of gender, in which he feels that all women should be “nice” and obedient. In one of their mentoring sessions, he advised her that in the American system you have to hide and hedge your ambition, and you have to do things to help other people without complaining too much. Stung by his assessment, she nonetheless made an effort to change.
“Actually, you know what, the first time he talked to me about emotional, I will accept because I also know I’m a little emotional. So yeah, I told him I would improve. The second time, he still mentions emotional, I feel hurt. Third time, I feel hurt. This time really hurt. He said yes, you don’t have relationship problems, but you left a bad impression.”

Lifen is especially upset because she feels that the people around her are not nice either and yet they somehow seem to get away with it.

“I notice some other American ladies, they are not nice either. (laughs) They are emotional. But I don’t know how others interpret it. Maybe some ladies are very beautiful. I think they benefit from it. Maybe they don’t have an English problem. Their culture fits into this environment. They hang out with them after work, so even if they are emotional at work, I guess they get forgiveness.”

Through Lifen’s complaint, we can begin to see some of the ways in which her gender identity combines with her Chinese ethnic identity impacts how she is perceived in the workplace. Lifen outlines a number of scenarios that white women can fall back on to be forgiven for not being nice: their conventional beauty, the ability to smooth it over through language, or the ability to explain themselves outside of work. It is not that white women are exempt from niceness – they still must maintain this mask. But they have ways to compensate for lapses in their behavior that Lifen feels are not available to her or other Chinese women. Lifen has two other female East Asian colleagues who do not chafe at this in the same way that she does. They are “introverted, not good at fighting”, she says. In her comprehensive study of Chinese engineers in the U.S., Gu (2016) notes that Chinese women are especially subject to expectations that women should be docile and compliant (2016:126). This draws upon both traditional Confucian expectations of women’s quiet obedience, along with exoticized stereotypes of submissive Asian women that persist in Western cultures. Conflicts arise, Gu notes, when Chinese women do not conform to these expectations, as it is seen as being particularly “unladylike”.

Becoming a “Problem Person”
Lifen is afraid that her complaints to her manager have given her a reputation as a dreaded “problem person”. As previously mentioned, there are consequences for becoming known as a person who complains too often about their workload and other aspects of their work lives. Furthermore, claims of discrimination by gender or race/ethnicity are not generally well-received and will almost certainly earn someone the reputation of being a problem person. As a result, most of my participants were careful to hedge their statements with refrains like “I don’t know if it was because I’m a woman or if I’m young or inexperienced.” Such statements reflect the real confusion women feel over how to identify mistreatment at work and how to determine whether their coworkers’ behavior is fair. They also reflect an understanding that to voice these concerns outright would mean risking their reputations as serious, hardworking engineers. This was evident in my first conversation with Lifen, during which she was more cautious about entrusting me with her complaints than in future meetings. Consider the following thought progression:

“It turns out that after my last year’s hard work, [my boss] didn’t give me a promotion. Sooooo here you go. I’m not sure whether he thinks - because my husband recently left [the company]. I’m not sure if it’s because he thinks I will leave because my husband already left. Or it’s because my ability? I’m not capable of becoming a principle engineer? Or is it a kind of…invisible discrimination. Working discrimination. You know you cannot mention it. If you mention it, you have trouble. You cannot find a job in the future. But maybe there is some. I wouldn’t say 100%. But I would say this factor is part of it, my feeling. He thinks, umm, ladies will, should, support their husband, don’t need to work so hard.”

The ordering of possibilities here is interesting. First, Lifen felt compelled to list several reasons other than discrimination that could contribute to her situation: her husband also left the company, she is maybe not a good engineer, or there is discrimination because her boss feels that women should not be so ambitious. These other possibilities must be listed first before a credible claim of discrimination can be considered, as if discrimination is something that can only take
place in the absence of all other rational reasons, rather than in addition to or alongside. Even after carefully listing the alternatives, the claim must also be hedged. “I’m not 100%”. This is part of what Mills et al. (2013) have called a “refusal to know”, which enables engineers to willfully ignore, misunderstand, or downplay clear signs of discrimination. Drawing upon Tuana’s (2006) “production of ignorance”, Mills et al. argue that the ability to recognize gender and racial discrimination in the workplace is obfuscated through practices of negating the significance of gender and race, erasure and/or forgetfulness of credible knowledge, and persistent debates over knowledge that has been reliably demonstrated. Just as knowledge is produced, so is ignorance. In this instance, although it is highly likely that Lifen has experienced a very common form of gender-related discrimination - defined as being treated differently by her boss because she is a woman - the additional rationales and hedging offer a justification for doubt. Lifen interprets - correctly, I think - the consequences of not including the additional reasons, and acts upon the norms established within the company culture. In doing so, she is making an effort to protect her reputation. However, the offshoot effect is to contribute to an ongoing production of ignorance about how and why gender discrimination persists in the workplace.

Furthermore, while women are sometimes willing to acknowledge gender discrimination, claims about racial discrimination are strongly avoided. Enofe, who carefully detailed several instances of racial discrimination he has experienced in the U.S. and Germany, feels he cannot talk to his coworkers about racial issues at work because they tended to brush them off:

“They would say, ‘Oh those are stupid people, there are stupid people everywhere.’ They would pass it off that way. They’d try to wave it off. Or they would just - some of them would just get quiet and try to make sense of it. But I didn’t want it to be the focus of most conversations, so I kinda laid back about it. You know. You just go with the flow.”
His coworkers’ deep discomfort talking with him about racial inequalities was a clear deterrent to bringing up his experiences. Enofe learned as a result to stop talking about these concerns.

Similarly, when I ask Ilma (F, 40, Pakistan) whether she has experienced any discrimination due to her Pakistani Muslim ethnic identity, she shakes her head.

“I try not to think like that, but I’m not completely sure. For me, the thing is that I do not want to think negative things. Whatever people think. I’ve seen so much in my life that things have become relatively not important to me anymore. ((You can just pretend it’s not a big deal.)) Yes, pretend it’s not a big deal. Yes. You know I’ve told you my life story. There is so much that’s happened to me. We have been through so many things. We are immigrants. We just survive.”

In contrast with gender discrimination, there does not seem to be a common discourse that would enable discussions about race to take place. Although examples of gender discrimination are made highly visible through women’s organizations, knowledge of racial discrimination in engineering, and the particular ways it manifests, are not as clear. Most of the dialogue about race in semiconductor engineering centers around skills, preferences, and cultural knowledge. For example, Chinese engineers are stereotyped as being highly technical, but not as good at communication, due to language and cultural gaps. Indian engineers are seen as more entrepreneurial, deftly navigating the corporate ladder. There also are perceived to be distinctively “European” ways of doing things that contrast with American corporate cultures.

These discrepancies lead to ideological camps that debate the proper way to do business on the leading edge. The practice of framing racial stereotypes in terms of innocuous preferences or differences of opinion is resonant of the ways in which diversity is often framed in the

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4 I would like to acknowledge that my position as a white researcher is important when conducting interviews that ask about racial identity and discrimination. While there were many people who were quite comfortable talking to me about these issues, I presume that many withheld information that they felt I would not understand. These issues are common in qualitative research, leading some to question whether interviewers and interviewees must share a similar racial/ethnic background (see Bhopal 1995). However, other studies have suggested that productive conversations can be “triggered” by the interviewer specifically asking about incidents of racism, indicating that they are familiar and sympathetic with these occurrences (Anderson 1995). This was the technique I used in my interviews.
workplace, as a rainbow of differences with little mention of power structures. Recent waves of diversity scholars have critiqued these practices, arguing that rather than treating diversity as a simple collection of differences that should be celebrated, more attention to structure and power should be included in corporate diversity trainings (Williams, Kilanski, and Muller 2014). As Edelman et al. (2001) write, “diversity rhetoric… tends to equate differences based on geography or taste in sports or dress style with differences based on race or sex” (Edelman, Fuller, and Mara-Drita 2001:1626). The discussion of racial stereotypes in terms of skills and preferences masks structures that enable racism at work, such as hiring and promotion biases and social network composition discrepancies. For example, managers who are in the “soft skills” camp, may exhibit preferences to promote employees with good communication skills, potentially leaving behind migrant workers who find it difficult to compete in this area. Without an understanding of the structural inequalities that underlie these differences, there is no sanctioned way to discuss racial discrimination at work. Thus, employees have little option but to ignore the slights they experience at work, or perhaps even train themselves not to see them at all, convincing themselves that it is something else, related to age or skills, rather than their race, ethnicity, or country of origin. The consequence of this silence is a whitewashing of corporate culture and an inability to recognize racial discrimination when it occurs.

Furthermore, due to heightened sensitivity to racism and the risk of becoming a “problem person”, silence about race is the default way to avoid offending one’s colleagues. Wingfield (2010), in her analysis of racialized “feeling rules” observed that Black professionals felt they were unable to speak freely about race, even in settings like diversity trainings where those feelings were solicited from attendees. “As with expressions of anger, respondents believe that there are two different sets of feeling rules in the professional workplace: one for white workers,
who are allowed to express their feelings about racial issues in diversity workshops; and one for black workers, who are not permitted to articulate their true emotions about racial inequality in these or any other settings” (Wingfield 2010:263).

Furthermore, as Ilma hints in her statement, recognition of discrimination can itself become a barrier to engineers’ ability to effectively do their job. Forsythe (2001), working amongst women working in artificial intelligence (AI) noticed that women who have succeeded in the field have learned not to see discrimination, not to experience it as discrimination at all. In contrast, women who did see discrimination found it difficult to continue their work. To succeed, she argues, women were subtly entreated to “join the silence or leave the field” (Forsythe 2001:181). Similarly, Ilma does not want to think about discrimination, because it is not helpful. It is not recognized, it is not corrected, and then you have to live through it anyway. From this perspective, it is better just to try not to notice. “We are immigrants,” she says. “We just survive.”

Conclusion

The multicultural nature of the semiconductor industry is one of the most attractive features for engineers working in this field. Nearly everyone I spoke with excitedly described the delight they feel in being able to interact with so many people from so many different areas of the world and their ability to learn about other cultures and traditions through their work in the integrated circuit. However, it comes with its challenges in the forms of misunderstandings and disagreements about the best way to “do engineering” in the workplace. Not only is the American style of engineering undergoing a transformation to include more “soft skills”, resulting in generational splits within the profession, but there are additional layers of cultural preferences depending upon one’s place of origin. This cultural complexity makes it very
difficult to ascertain whether discrimination has occurred, since workplace biases are multi-layered; gender biases are compounded by ethnic biases, generational biases, and other biases associated with preferred work styles. In the midst of so many conflicting opinions, along with strong cultural taboos against causing trouble, the result is that engineers feel compelled to simply sweep discrimination under the rug. Forsythe (2001), pondering the career risks for women who “see discrimination”, wondered whether it was ethical to tell them, to make discrimination visible, knowing that it might negatively impact their success. I confess to sharing that concern, since a certain blindness to it, a refusal to see, seems to be a critical condition for continuing to “get along” in the integrated circuit. However, to be fair, the “production of ignorance” (Tuana 2006) has not moved the needle for gender and racial equity much either.

Though multicultural in workplace composition, semiconductor manufacturing culture is localized for each region, within each company. While working at German sites, for example, migrant workers adopt German working conditions, including reportedly shorter workdays, no work on weekends, and a workplace culture known for its high quality project management and punctual delivery dates. In this American region, migrant workers are required to adapt to American cultural preferences, with its focus on leadership and communication. Engineers from all over the world mold themselves to fit - comfortably or uncomfortably - within niche groups in the workplace, which requires complex negotiations of identity. In the following chapter, I will show how promotion structures shape who succeeds according to the logics of American engineering and business culture.
CHAPTER V
In/Visibility: The Politics of Getting a Promotion

On a Friday night, Janaki (F, 42, India) and I are sitting in the upstairs loft of a gymnastics studio. It is our usual meeting place – the only time when she is able to squeeze me into her incredibly busy schedule. As we watch her daughter and teammates tumble to music from “The Little Mermaid”, she vents her frustrations about her career path. Janaki knows she has been lucky. She is highly talented and has rocketed upward through the levels of hierarchy at her company. She was recently promoted to a second-line manager position and is the only female Master Inventor – a prestigious nomination – at the company, perhaps in the region. However, it hasn’t been easy, and she frequently feels pressured into management roles that she did not seek out herself. She prefers a technical career path, performing critical research and discovering new processes and technologies. But her managers insist on asking her to manage employees, drawing her away from her beloved research. She resisted being promoted at first, but the company desperately needed someone to fill this position, so she begrudgingly agreed. “It was a business need,” she explains. “I didn’t have a choice.” Since then her life has been constantly attending to the crisis of the day and the needs of her employees. She has very little time to focus on her research. “I’m not learning anything,” she says, forlornly. “I’m just…sailing along. Just…whatever. It’s just a job that pays money right now. It doesn’t excite me. My engagement is zero.”

This lack of engagement is compounded by the sting of not getting the recognition she deserves after her promotion. At the meeting where her promotion was announced, Janaki was overshadowed by a younger man making a lateral move. Despite her longer years of experience at a higher rank, her boss made a big speech about the younger man’s experience and expertise,
and projected that he would revolutionize the organization. “I’m sitting right in front of them across the table,” Janaki reminded me. “I’m projecting the charts. Not a single word about me.”

Stunned, she sat through the rest of the meeting. No one said a word about her being left out. Afterward, she confronted her new and old managers. She directly accused them of gender discrimination, hoping this would force them to take her issue seriously. Her managers claimed the younger man needed more exposure. “Everyone likes you,” they reasoned. “They already know you will do a good job. For the other guy, we had to work him up.” Janaki disagreed. “You know that,” she said. “The uppers don’t.” She felt the senior VPs who didn’t know her wouldn’t necessarily have heard about her, and for women especially, it is important to make a positive first impression.

To make matters worse, she also found out two of her new subordinates made more money than her, even after her promotion. She asked that this be rectified, on principle. She didn’t need the money, but she felt this was about respect and fairness. Her new manager told her there was no money in the budget for a raise. As a compromise, he offered that he could return her to a technical role the following year, but there was nothing he could do at the moment. It was hard for Janaki to move on from this sense of being undervalued. After all, she is a Master Inventor with over a decade of experience. She is excellent at her job. And the company prides itself on inclusivity, particularly in the form of women’s advancement. Surely if a senior female manager made complaints like these, the company would make every effort to put things right. She had trusted and fully believed that was true, and now she realized it was not going to happen.

The lack of recognition of women permeates down to lower levels as well. One day, I was out for lunch with Xiaoli (F, 35, China) and we happened to go to the same restaurant as some of her team members. Xiaoli and I have a mutual friend, Ning (F, 39, China), who was
passed over for a promotion three times, despite being told by her manager that she was overdue for one. As we reached our table, Xiaoli whispered to me conspiratorially, “He has been promoted three times.” I covertly glance over to see a big man with cropped hair and a goatee. Xiaoli continued to explain that this was the person who had gotten the promotions that Ning felt she deserved. It had been a major scandal at the time. Usually lower level promotions come like clockwork, one every couple of years. But not for Ning. She had been working for the company for seven years and had only received one promotion. Ning reflected to me later:

“[At first], I didn’t want to require a promotion. I just feel okay, year by year, others are promoted, not me. Then I request it. My boss always comment every year, it’s time you should be promoted. You deserve it. But every time it’s not happened!”

The last promotion cycle, she lost her temper. Ning is such a quiet, shy person, it was difficult for me to imagine her raising her voice. But after failing to be promoted the third time in a row, it had been a bridge too far.

“I tell my boss I don’t want to speak to you anymore. (She laughs, in retrospect.) Yeah I screamed at him. And I think my boss didn’t like to see me like that. I just tell him that I don’t want to speak to you now. It’s because I’m in quite a bad mood at that time.”

Her boss apologetically explained that he only had one or two promotions to give out, but Ning felt that she had been passed over too many times. She grew very discouraged and unhappy.

Women’s experience of being undervalued is a difficult phenomenon to describe since so few people hold concrete evidence of what goes on in promotion panels, and that information is rarely made public in a way that would allow for a systematic analysis. However, many women in this study describe feeling that they are being outshone by their male colleagues, stripped of prestigious work, or passed over for promotion for opaque reasons that they don’t understand. They have a nagging sense of unfairness, but no way to verify their suspicions and few concrete actions to take that would rectify the inequality. I have previously mentioned the dangers of
becoming a “problem person”, a threat that hangs over women and minorities who make claims of discrimination. Even if they have evidence and feel justified in their assessment, most women I spoke with felt it was not worth it to stir the pot. For many, it seemed better to keep their heads down and continue to outperform everyone’s expectations. But the cost is a sense of buried injustice that becomes lodged in their hearts, always ready to be recalled at the slightest provocation. Past arguments reverberate long after they have been smoothed over. Unresolved, they fester and contribute to a persistent feeling of unfairness, neglect, and hopelessness.

The persistence of gender inequalities in the promotion structure are a reflection of deeply held dualisms that sharply contrast men and masculinity with women and femininity. Building upon the work of “boundary heightening” (Kanter 1993) outlined in the previous chapter, dualisms such as technical/social and rational/emotional underlie “structural gaps” (Bourdieu 2001), or architectures of inequality which consistently result in men’s higher achievement in the promotion cycle. Women in engineering, Faulkner (2011) argues, find themselves in a position of “gender in/authenticity”, an incongruous position on the boundaries of these gendered dualisms, in which it is difficult to be recognized as “real women” and “real engineers” simultaneously. Faulkner argues that this dynamic contributes to an “in/visibility paradox”, a concurrent status of hyper visibility as women in a male-dominated space and invisibility with respect to their role as engineers (2009b).

The process of achieving promotion is an exercise in molding oneself to the expectations of the company. Building upon Foucault’s concept of governance and self-technologies (Foucault 2016), the incentive structure of promotions is a process by which institutions set guidelines for employee behavior and produce rewards for individuals who mold themselves to fit these expectations. Foucault cautions against granting institutions themselves too much
authority, since it is people – CEOs, financial backers, managers and employees themselves – who wield power and enforce discipline. While policies are formalized by institutions, they are crafted by leaders, implemented by managers, and enforced through shame, gossip, and competition amongst coworkers. Furthermore, in Foucault’s view, individuals do not have full ownership of power - or resistance, for that matter - but instead wield power through the use of discourses, which are the true locus of power.

One of the central discourses in the promotional incentive structure is that of productivity. Gregg (2018), in her critical analysis of self-help literature, building upon the work of Sloterdijk (2014), argues that productivity discourse is a form of “athleticism”, in which believers discipline themselves to reach ever higher levels of performance. Like Foucault’s assessment of Christian confession as a tool of dominance (Foucault 2016:59), productivity discourses demand the confession of one’s time-wasting sins. Employees are requested to recount all activities and rank them according to measures such as “important”, “unimportant”, “urgent” and “nonurgent”. What counts as “important” is culturally determined, however, in office settings, it tends to map onto the company’s profitability and strategic priorities. Employees must have a sense of “omniscience” in order to predict – usually without manager assistance – what types of work will be most highly valued by the company. Formal employee training has long been eliminated in most corporate workplaces - an offshoot of neoliberal policies that view up-front investments in employees as a wasteful use of resources - leaving employees to make educated guesses about what type of work is most valuable.

Once confessed and assessed, tasks deemed to be “unimportant” must be eliminated or delegated to other employees. Gregg argues that this instruction implicitly demands that “successful employees” view other employees as less important than themselves, dumping
“unimportant” or “nonurgent” tasks onto others. Among this “unimportant/nonurgent” work includes the “social” and “collaborative” tasks that may be perceived as too time-consuming when compared to a single employee making an executive decision. One self-help book discourages allowing other employees to “waste their time”, advising readers: "’Do you have a minute?’ usually means 'May I have your attention now to talk about something that will take an unspecified length of time?’" (Gregg 2018:67). Thus, collegial tasks of helping other coworkers similarly become an exercise in elimination for the sake of one’s own personal success.

“Unimportant” work is implicitly gendered and racialized. Women carry additional expectations for emotional labor at work, resulting in greater offense if they choose to refuse help to another colleague (Hochschild 2012; Wingfield 2010). In addition, women of color are routinely tasked with “diversity work”, which takes time away from work that counts as “productive” labor. In academic settings, Black women’s substantial contributions to service work (whether voluntary or mandated) has been characterized as “academic housekeeping” (Smith and Garrett-Scott 2021; Harrison 2008; Collins 1990), which detracts from their ability to produce publications that count toward tenure and their broader academic legacy.

The final blow of productivity discourse is that the promised payouts – promotion, recognition and “success” – are not guaranteed. After these tremendous acts of self-discipline and self-isolation from one’s teammates, employees may find that they have chosen the wrong tasks to focus on or been outshone by someone else performing work deemed more essential to the company. They may have “unimportant/nonurgent” work dumped on them by others and be unable to delegate to someone else. Or they may simply find that the promotion process does not work this way at all. In semiconductors, I find that the process of promotion is particularly opaque and impossible for women and minorities, who as a result of the in/visibility paradox,
tend to be dumped the greatest amount of “unimportant/nonurgent” work, and for whom being promoted is an entirely different game than the one played by their white male colleagues due to gendered expectations of caregiving, both at work and at home.

**Above and Beyond**

Career advancement is another arena in which American workplace culture appears to differ in relation to other parts of the world. In particular, employees who have spent time working in Germany remark upon how promotion-obsessed American workers are. Perhaps an offshoot of American individualism and productivity discourse, Americans have strong motivations to move up through the levels of the company hierarchy. Enofe (M, 35, Nigeria) remarks that his coworkers in Germany were comparatively “satisfied”, unconcerned about being promoted, more concerned about their lives outside of work. In the U.S., however, he observes that his new workplace is significantly more competitive and there are more levels of hierarchy. “In Dresden, you may have a manager with as many as 30 employees beneath him. Here in my group, we have managers with just four employees, five employees.” The additional layers of stratification in the U.S. means that more people are promoted each year, which in turn normalizes the expectation of promotion. By creating more management positions, the company generates greater desire to unlock these levels. For women and minorities, promotion is particularly desirable as the last remaining hurdle for gender and racial equality in the workplace. Having succeeded in thriving in a white, male-dominated environment, the final level of success is to break through the “glass ceilings” that have shielded male privilege at upper levels of the corporate hierarchy.

The promotion process varies from company to company, but generally is intended to function as follows: Each manager has one or two promotions to give out per year. The names
and accomplishments of employees recommended by the manager are handed up to a panel for review. The employee’s performance reviews, publications, patents and other significant achievements are considered by the panel and panelists give an up or down vote regarding whether to grant the promotion. Lower level promotions are relatively routine. For the first two or three promotions, the criteria are based more upon seniority than any other factor. With greater experience and longevity at the company, engineers can expect to get a bump up to the next level every two or three years. These first few promotions come with additional responsibilities, but do not yet require engineers to manage other people.

At the level of becoming a manager and continuing up the corporate hierarchy, promotions become increasingly competitive and criteria become increasingly opaque. One of the core criteria is the mandate to go “above and beyond” one’s usual work activities. In addition to the work an employee is assigned day-to-day, she must also perform additional work that will showcase her skills and expertise. Patents and publications are the most common achievements employees begin to acquire when they arrive at the company. Getting the first patent is a struggle, and frequently requires the mentorship of an advisor or manager, but once engineers have been through the process once, it is easily repeatable. Lower level employees may hold 5 or 6 patents. To earn the prestigious title of Master Inventor, employees must hold a minimum of 20 patents. Janaki (F, 42, India) has 33 patents, but she tells me the average amongst Master Inventors is 60. One man she works with holds 1,400 patents. His resume is so well-padded that he shows up to work in sweatpants, she grimaces. Publications are more complicated since it is harder to be published in academic journals from a corporate research setting. Instead, employees publish in trade journals and present their work at regional and national industry
conferences. Michelle (F, 44, Indonesia) tries to publish one paper for each patent she collects – that way if she loses track she can just look it up in the journal or conference proceedings.

Another “above and beyond” project employees might take on are trade secrets. These are immensely more valuable to the company, Lucas (M, 35, France) explains to me, because they directly impact the manufacturing process and help the company keep an edge on their competitors. However, racking up trade secrets is risky for employees. Trade secrets belong entirely to the company and are not transferable if the employee is laid off or changes companies. In addition, it is prohibited to publish on trade secrets, which diminishes employees’ impact outside of the company.

Finally, there are process improvements, in which employees may choose an internal company process to analyze and streamline. Six Sigma is a popular lean manufacturing certification program that helps employees identify and reduce inefficiencies in work processes. The certification levels, named after Japanese karate levels - green belt, black belt, Master black belt - all require an applied project within the company in order to complete the certification. While less common in semiconductors and somewhat less prestigious than receiving a patent, Six Sigma certification is at least transferrable to future employers. In addition, this certification is valuable in many manufacturing environments outside of semiconductors, making it possible for employees to change industries if needed.

The completion of these “above and beyond” projects requires significant time and energy on top of completing their own day-to-day responsibilities. Engineers seeking promotion work longer hours, sometimes logging in late at night to take care of their career advancement projects that they were unable to focus on during the day. The extra hours are not compensated but contain an implicit promise that their efforts will be rewarded by the company in the form of
a promotion or other recognition. As Gregg points out, this reward does not always materialize, indicating that there are other crucial factors for promotion that are less visible.

**Invisible Criteria**

In an attempt to understand what she needs to do to reach her next promotion, Vidya (F, 44, Indian American) has consulted with a close friend and mentor to help her understand the political angle of promotion. As we sit at her kitchen high bar, she sketches out a diagram. She places herself as a dot in the middle of the sketch, with an arrow pointing upward and an arrow pointing downward, and another arrow pointing to the side. She explains, “I do a lot of work that is visible to the people below me, and to the people at my own level. But I’m missing work that is visible to the people working above me.”

![Fig 4.1 Vidya's Work within Her Team](image)

She then draws a “house” sketch around the whole diagram to indicate the boundaries of her own team and an arrow pointing something outside the house, saying, “I also do a lot of work for other teams that no one in my team sees at all.” This is essentially wasted effort, she explains, since other people get to take most of the credit for that work. She strongly believes that this coordination work is essential to keeping the company running efficiently. But it will never earn her a promotion because it isn’t visible.
Vidya’s understanding of the politics of visibility is essential to understanding how to get ahead in the company. In this interpretation of “important” and “unimportant”, work that helps teams other than your own is deemed non-essential and wasteful in the context of furthering one’s own career. Vidya explains that there are many people she works with who refuse to do the work of collaboration between teams for precisely this reason. Mallette (2017) borrows a term from economics to describe this phenomenon: satisficing. Rather than doing an excellent job at nonessential tasks, employees satisfice, or do the bare minimum, and refocus their efforts on work that is directly applicable to their own personal success. Mallette finds that in engineering, men are far more comfortable satisficing than women. In contrast, women take a wider view of efficiency and success, including calculations that recognize how large investments of time up front save time later in the product cycle. This is Vidya’s argument: the work she does makes the company more productive and cooperative in the long run, but is less tied to a direct, measurable, short-term achievement.

To make matters worse, outside collaborators often take Vidya’s advice and then pass it off as their own in their communications with upper management. She emphasizes the arrow from herself to a second dot representing an outside coworker and then another arrow pointing straight up toward upper management (see Fig 4.2), showing how her ideas are used to create
visibility for others. She watches these men (because they are mostly men at this upper level) advance in their own careers, even as she defends her own principles. She sees clearly what is happening but finds it difficult to refuse to do the invisible work that she feels is critical to the operation of the company. It is unfortunate that Vidya’s self-sacrificing loyalty to the company instead of being rewarded undermines her prospects for advancement.

Perhaps even more important than an employee’s personal visibility is their manager’s visibility and strategic position. This component of promotional structures is typically overlooked in our over-emphasis on individual agency and productivity discourse’s assurances of hard work paying off. However, multiple participants in my study feel that their managers lack sufficient political capital in the company to properly advocate for their employees’ promotions. Both Janaki and Vidya currently find themselves in this situation. Janaki, after expressing outrage at her manager refusing to correct her salary, shrugs and sighs in a resigned way. “He really has good intentions, he wants to make a change. But he’s not able to. He’s not local. He works in another location and comes here once a week…He doesn’t get along with many people. There’s a lot of politics going on and…a bunch of stuff.” In Vidya’s case, her manager has been shifted to marginalized projects following the last layoff at the company. She has been finding it difficult to predict what projects will become “high priority” in the future that might grant her additional visibility for promotion. She has been seeking his mentorship, but he has not been able to provide strategic advice due to his marginal position. She is disappointed at the realization that she will probably have to maneuver out of this group to be recognized for her efforts.

Finally, as employees move upward through the ranks, their personalities are molded to become a better “fit” for leadership roles. Few employees enter the workplace with all the
characteristics desired for management roles, but these are learned along the way. One promotion at a time, the rough edges are gradually sanded off and worker resistance is repurposed toward alignment with company strategic priorities. Mandira (F, 35, India), who was recently promoted to her first management position this year, is currently in the midst of the transformation from engineer to manager.

“I think work wise, the most challenging was the transition from the technical side of work to more of a management kind of role? I was trying to in the meetings if somebody was attacking a person, that person was getting victimized or something like that, I would always take the victim’s side. And not the business mode, but think more, like, of personal things. I’ll just get attached to the victim rather than thinking, ‘Okay what is the right thing to do at this point?’ …like taking my own emotional path out in the meeting. I think that was very challenging.”

Mandira describes an incident in which a man was bullying one of her coworkers in a meeting. There was a task that the man did not want to do himself, and he began raising his voice in an attempt to force her coworker to capitulate and accept the assignment. Mandira demonstrates, “He would just…just say things so LOUD. ‘No, YOU have to do, I’m telling you like THIS.’” Such events are akin to what feminist theorists have termed “sonic patriarchy” (Thorkelson 2020; Lentjes, Alterman, and Arey 2020), in which men use volume to drown out and wear down their opposition. Sonic dominance succeeds in excluding the voices of outsiders, including women, resulting in either their retreat from the conversation or a “feminist snap” (Ahmed 2012), in which women lash out to make their voices heard. Mandira’s instinct was to protect her coworker against the attack. She threw in her support as a new manager, saying, “No, he’s not going to do that, you have to do it!” The exchange escalated further as the louder man continued to dig in. Eventually a more senior manager weighed in with a calm demeanor. The voice of reason was like a balm, soothing the overwrought emotions in the room.
“He actually walked us through it, through the confusion. I was like, ‘Oh my god! This is how it should be done!’ Instead of just picking fights and making more of it, we needed somebody who is calm and can just tell it. That’s the best.”

Mandira admires the way the more senior manager was able to put his own emotions aside in order to de-escalate the conflict. However, this incident continues to bother her long after its resolution. This is in part due to the outcome – her coworker was forced to accept the task that the bully refused to do, in the name of keeping the peace. “So [the bully’s] request was not unreasonable, it was the way he asked for it,” Mandira explains. The lesson she learned has been to detach the emotion of the speaker from what is being said. However, it niggles at her because she understands the larger context. The bullying incident was not an isolated event, but a pattern of behavior. This man complains about her meetings regularly. “He would send me an email, ‘I don’t know what you’re doing in this meeting, I don’t get this and that,’ and he gets really upset. And I’m like, ‘Why does he feel that?’” She recognizes his behavior is inappropriate but is not sure how to deal with it. The example set by the calmer, more senior manager is to allow him to continue to bully his coworkers as long as his requests are reasonable. This conflict lingers as a prolonged uncertainty in Mandira’s mind: “I’m not even sure right now. I’m not sure if what I did was right or wrong.”

Furthermore, Mandira worries about how this incident reflects on her management style to others at higher levels of the company. She seeks her boss’s advice regularly to try to learn how to handle these types of conflicts, but she worries that this is perceived as “complaining”. “Maybe I should stop my complaining. I was complaining a lot to my manager. He put a lot of trust in me to give me this role, and I’m just complaining, ‘No, these guys are bad!’” Seeking her manager’s advice on this subject is risky for her, because she cannot always be certain that others
know the larger context of repeated bullying incidents. In this case, her complaint to her manager resulted in him escalating the event to *his* manager. This was deeply unsettling for Mandira.

“I’m contemplating the other day why it is worse that it’s on my side that my manager is talking to my second level manager, like, ‘She cannot do it?’ Does it look bad on me that I cannot handle even this correction? My manager is very understanding, it’s just because I didn’t know. But the other manager I don’t know.”

The unfairness of this scenario is stark. It is not the bully’s manager who is involved in solving the problem, but Mandira’s manager. So not only has he succeeded in offloading his work to his coworker, he has also offloaded the conflict resolution to Mandira. To make matters worse, the managers involved may not fully understand the context since they may not be familiar with the bully or his reputation of bad behavior. Instead, the incident becomes a problem with Mandira’s management skills, and her inability to properly screen “unimportant/nonurgent” emotional outbursts from the workload of her upper level managers.

In accordance with management discourse on “growth mindset”, Mandira is trying to treat this as a learning process.

“I’ve never done this before. You’re managing all a lot of people, ‘Do this, do that, do this, do that.’ I suppose I wanna learn. I’m trying to now accept that. And I think that if I go through this, I’ll get better at it. I’m just keeping my emotions…I shouldn’t just be so quick to make a judgement oh because this guy is…just take my emotions out of it for a time and think about it. It was like a very emotional reaction.”

In this passage, Mandira has accepted and internalized the blame for this scenario. Rather than interpreting the event as an emotional outburst on the part of the bully, who raised his voice and provoked the emotions of his coworkers, Mandira has reframed the scenario to reflect that she is the one who is emotional. It is her emotions that must be disciplined, her behavior that must be more carefully controlled. Thus, the process of “growth mindset” in this context functions as a tool for employees to internalize incidents of bullying, sexism, and racism as opportunities for
personal growth, while ignoring the contextual factors that have caused harm and disruption in the team.

Furthermore, Mandira tasks herself with putting her own well-being and that of her coworkers and subordinates second to the larger goals of the company. The company requires her to ensure that the work gets done. The bully is not going to do it, so the more obedient employee must take it on. The company requires a harmonious workforce, so the team must work to minimize the impact of the bully’s misbehavior, disciplining themselves to sublimate their own defensive reactions, sacrificing their own emotional protection. All of these things must be accomplished while protecting the time of the upper-level managers, whose work is too important to be interrupted by discontent at lower levels. This process of grooming will take years and will be imperfectly learned by each individual. However, Mandira’s ability to achieve the next promotion relies upon her willingness to learn to “see the bigger picture” from the perspective of the company’s strategic goals.

Along with shifts in moral perception, managers also learn to follow particular management styles. As part of their management training, new managers are exposed to the DISC personality type tool, created by William Moulten Marston (People Keys 2020). Billed as the “color palette of the personality”, the model identifies four core personality types (Dominant, Influence, Steadiness, and Compliant) that have been used to predict behaviors and resolve conflict in corporate settings for the past 30 years. After taking a personality questionnaire, employees are encouraged to classify themselves into one or more of the core types. As a governance strategy, personality testing validates the visibility of marginal personality types in the company and assures employees that their personality has a significant role to play on the
team. It also provides managers insights into employees’ core motivations, which help ensure their compliance and productivity on the job.

Although each employee is reassured of the value their personality type brings to the table, there is a clear preference for Dominant personality types for promotion. This is frustrating for employees who have identified with the other core values. Despite being told their personalities are necessary to the team, “I”, “S”, and “C” types are not equally valued. Vidya personally identifies as “an I” (Influence). The definition for her personality type reads: “Enthusiastic. Trusting. Optimistic. Persuasive. Creative problem solver. Great encourager. Motivates others to achieve” (People Keys 2020). Despite these stated leadership qualities, she feels stymied by the predominance of “D” type personalities at the top:

“It’s this whole alpha male, all these D [Dominant] Type personalities at the top. They’re all D’s! You very rarely see an S [Steadiness] or an I [Influence] in the executive group. And that’s frustrating. One of my friends is an S, she really, really is, and I am too. I’m on that line of I-S. And I want to see some management up there. And even the women that we see there are D’s.”

In this statement, Vidya hints at the complexity of these personality types and their inability to fully encapsulate employee identities. While she feels predominantly like an “I”, she also resonates with the “S” (Steadiness) personality type: “Good listener. Team player. Possessive. Steady. Predictable. Reliable and dependable. Patient and empathetic. Good at reconciling conflicts” (People Keys 2020). It is worth noting as well, Vidya’s recognition of the gendered nature of these personality types. “Dominant” types are “alpha males”, and even the women who are Dominant personality types are presumed to have taken on masculine personality features: “Direct. Decisive. High Ego Strength. Problem Solver. Risk Taker. Challenges the status quo. Innovative” (People Keys 2020). In contrast, Influence and Steadiness personalities contain language that is unequivocally relationship-oriented, and therefore coded
feminine. By extension, a privileging of Dominant personality types at the upper echelons protects male dominance of corporate leadership.

To mitigate some of the messiness of this method, the test distinguishes two dimensions of personality: management style and personal style. While Vidya’s personal style was “I-S”, her management style yielded surprising results:

“So we do the analysis two ways, your personal style, and I fell in the I-S, and then your management style, and it’s a totally different set of questions, and I’m in a different quadrant for management styles, turns out I’m a D in management style. According to the data. And I thought that was kinda weird but then I think…Every. Single. Person. I work with is a D, so I must be mimicking them!”

This observation reveals another dimension of governance through the management process. Through the grooming process of promotion, managers learn to behave in ways that are preferred for further promotion. This includes molding oneself into the masculine leadership model of a Dominant personality type, characterized by aggression, decisive action, and risk-taking. Vidya has ended up with a decided distinction between her approach in her personal life and her approach at work, requiring her to reconcile the behaviors required for survival at work with her internal compass that directs how she prefers to act and be perceived (which is also undoubtedly influenced by gender norms). Vidya’s discomfort with her results is notable in the offhand remark, “according to the data,” as if she cannot quite believe this is true. But she trusts the test, and the test has delivered this verdict. She does not see herself as a “D”, and therefore has to do additional work to reconcile this result: “I must be mimicking them!” Her “D” result is therefore rejected as a “natural” part of her personality, and becomes instead something that has been acquired, a consequence of working in a male-dominated environment for so long.

Alongside adopting new personality traits, employees must also learn confidence and assertiveness, and develop the capacity to perceive how and when it is appropriate for them to
advocate for themselves. This is a political skill, which can be difficult for engineers who have been trained to view their achievements in objective, meritocratic terms. Shuang (F, 31, China) captures the nuance of this task:

“I think that’s important, to figure out when or how to promote yourself to different managers. A lot of people do a lot of hard work, but they never speak up. And they didn’t get what they deserved. You need to let people know your hard work. [However] I think I learned that some of the managers it was not really helpful to promote yourself. That’s why I mentioned, some managers they micromanage. So maybe they leverage your concerns about how they push out the works through you. That kind of manager I wouldn’t do that. But for a manager like my female manager, I talked to her directly, and told her I transferred so I already delayed my promotion, I hope I worked hard to get this early. She really understood that.”

The process of determining how and when to promote one’s own work requires an individualized assessment of the audience. It is not a formula that can be applied uniformly to all managers. It requires an understanding of power and hierarchy, an assessment of which managers are important to influence and how that manager is likely to respond. It requires political skill to be able to brag about one’s accomplishments without seeming too self-congratulatory. It requires the ability to assess whether it matters if certain people think you are self-centered – while it does matter for your manager, it might not for your coworkers. These are complex political maneuvers that employees must learn to employ selectively in the workplace.

The requirement for social and political maneuvering comes as a surprise for many engineering graduates. Engineering education emphasizes physics, mathematics, and other forms of technical expertise, to the near exclusion of other subjects. The expectation of early-career engineers is that if they perform the technical requirements of their job well, that work will be recognized. For Enofe (M, 35, Nigeria), frustration began to set in as he realized he was not playing by the right set of rules.

“In Germany one of the impressions I got was you have to be tipped. You have to have a manager who sees that quality and enable you and help you. In the US, it’s not…I do my
work, only the people who work closely to me see the quality of work that I do. I might not be all jumpy and talking and all that. And that’s what I didn’t like about my manager at first. He was all about the presentation of everything. You need to see me, notice me, kind of thing… I just don’t like all that.”

Enofe feels uncomfortable with the showmanship that is required to promote his work outside of people he works with every day. He contrasts American promotion systems with German systems, in which managers are on the alert for employees who do exemplary work.

While it is probable that there are cultural distinctions in how promotions are determined in Germany and the U.S., this misunderstanding of the rules is common for early-career American engineers as well. Believing fully in the promises of productivity discourse, lower level engineers trust that hard work will speak for itself. This belief can persist a fair way up the management chain until one’s career inexplicably stalls. Given the high motivation to achieve the next promotion, bad advice proliferates amongst the rank-and-file, muddying the waters of what is needed. Enofe and many of his colleagues participate in self-help programs to develop their leadership skills and improve their confidence and charisma. One entrepreneurial mid-level engineer is particularly well versed in this literature, describing to me in great detail the value of “passive income” as a path to financial independence and security. His teenage daughter recently gave a presentation to a local high school on the “Seven Habits of Highly Effective People” (Covey 2004). It is not that these programs are not useful; they are a frequently a salve for those searching for meaning and personal growth. However, in focusing solely on individual self-improvement, these strategies neglect the relational nature of promotion, their political alignment with corporate strategic goals, and the interdependence between themselves and their managers, their peers. As such, they may distract employees from the critical work of going “above and beyond” and learning to navigate the political world of upper management. In addition, self-help leadership programs mold individuals into particular forms of leadership which are implicitly
gendered and racialized, and neglect to mention the importance of race and gender to performances and perceptions of leadership. Furthermore, these strategies draw upon this individual-centric, decontextualized advice to contribute to an ongoing reproduction of hope for advancement through sustained intensive self-improvement, for which the rewards may never ultimately come to pass - the hallmark of Berlant’s “cruel optimism” (Berlant 2011).

**Women on the Promotion Track**

Women’s promotion track is notably different than the standard path outlined above. For men, while the track is competitive, the process of selecting “above and beyond” work, increasing visibility to one’s superiors, and aligning with company strategic priorities and masculine management styles is difficult, but not impossible. For women, each of these steps becomes an exercise in balancing gender and work identities, seeking a place in the tiniest Venn diagram intersection between family- and work-satisfaction.

**Competitiveness with Other Women**

To begin, the pathway to management for women is narrower due to fewer number of positions open to women than those available to men. At the highest levels of the company hierarchy, comprised of 6-10 executive positions, usually only one or two slots will be held by women. Despite a recent study that shows that increasing women’s representation in leadership roles to 30% or higher results in greater profitability (Noland, Moran, and Kotschwar 2016), in the United States, nationwide, women hold only 15-22% of executive positions (Noland, Moran, and Kotschwar 2016). In the tech industry, women working in companies founded by men are found in mostly non-technical executive roles, such as Human Resources, Finance or Marketing.
While some studies have recommended including three or more women in executive roles to increase gender equity in corporate governance (Kramer, Konrad, and Erkut 2006), this is still a rare practice. Although some states require companies to appoint at least one female board member, or to disclose how many women are in the C-suite, many companies feel satisfied by appointing a single woman to fulfill the requirement (Forman 2019). As a result, while in theory all C-suite positions are open to women and men equally, in practice, women compete amongst themselves for a much smaller portion of the leadership circle.

Given the limited slots available to women at the top of the corporate hierarchy, competition amongst women for these positions becomes more fierce as one climbs the corporate ladder. Faced with the urgency of becoming a representative for all women at the executive level, and the realness of the possibility that they might achieve this Holy Grail, women forget to empower other women at their level and view them instead as rivals. Vidya remarks upon this dynamic of conflict between other women in upper management:

“As you move up through the levels, women become more self-interested. They will only help you if they are getting something out of it. Why would you bring competition up?...Just one or two women [at the top] becomes almost animalistic, territorial. It becomes competitive. And you see that. Women who don’t support other women. So I see sabotage. I see nonsense. I see ideas not being listened to.”

Vidya recently found herself in the uncomfortable position of potentially damaging the career of one of her female colleagues. She was asked in a hallway conversation what she thought of another female peer, and her first reaction was to say that the woman was very difficult to work with. Reflecting upon her actions, she feels badly about her temporary lapse in judgment. “All I did the whole night was worry, “Did I just push her under the bus? Is that what I just did?”

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1 Some studies have argued that the representation of women almost exclusively in leadership roles perceived as “feminine” – such as Human Resources - runs the risk of further entrenching gender ideologies that associate women with social, non-technical, non-aggressive roles (Chesterson 2005).
Janaki has also experienced this uncomfortable tension in her career, as both the recipient and the instigator of competitive aggression against other women.

“At another location of my company, there was a woman manager who had a baby and she came back in six weeks. She kept rising up and up and up. I judged her for that. I felt she should have been bonding with baby. Like how could you be so career thirsty? But what right do I have to judge her? That’s not being inclusive! I see that happen quite a bit.”

In these examples, corporate discourses of success and productivity war with discourses of women’s solidarity. Women in engineering are routinely told that they are representatives for women’s equality and their success in achieving promotions to higher levels of corporate leadership is a symbolic victory for all women. In order to achieve this success, they must fully buy into discourses of productivity, encouraging them to view their peers as competition and to prioritize only their own time and only their own success. These discourses wholly undermine the parallel discourse of women’s solidarity, which dictates that women will only succeed by banding together against patriarchal corporate structures, mandating a responsibility for women to lift each other up rather than dragging each other down. Trapped between these competing values, women spend energy in reflexive self-interrogation of the competitiveness that has been cultivated by the cultural environment. This tension has its positive value in that it produces reflection on gender ideologies. Both Vidya and Janaki catch themselves engaging in the same gendered assumptions that they critique in others, namely, judging women for exhibiting overly masculine behaviors, and criticizing their family decisions. They recognize their error and attempt to correct it. However, this work requires additional energy not spent on the “standard” track of promotion pursued so single-mindedly by men. Men have the privilege of not caring about who they “throw under the bus”, as Vidya puts it, on their way to upper management. While women are relationally bound to each others’ successes and failures, men are viewed truly
as individuals on the corporate ladder, liberated from the burden of caring about the success of others.

The “High” and the “Thud”

In addition to spending time and energy competing for fewer positions, women also spend time agonizing over whether they actually want a promotion or not. Given the aforementioned organization of labor in which domestic life is not accounted for in two-income households, women feel deeply ambivalent about the sacrifices they will need to make to reach the next level. Vidya knows she is functioning at a level higher than her current position, but she knows that making a strategic move to take on the higher priority projects and “above and beyond” work will dramatically impact her home life. “It’s a high and a thud,” she says, raising her hand up to eye level and then dropping it with a thud on the table. The job she would need would be very high profile, and therefore, great for her visibility to upper level management. When her husband was assigned to one of these projects, it was so strategically important to the company that it was all but assured that he would receive the next promotion available. It is thrilling to be a part of something so urgent and important - that’s the “high”. However, these high visibility projects also mean that executives breathe down your neck about them, resulting in the “thud” of the realization that your life is no longer your own. Employees are expected to work around the clock, they’re stressed all the time, they can expect calls from executive directors at any time of day, and they have no time for family. Given the gendered divisions of labor at home, it is hard for women to make the decision to consciously select one of these projects, knowing that their husbands may not be willing or able to pick up the slack at home, worrying about who will remember to organize their children’s birthday parties. This
ambivalence frequently results in inaction. They make a decision to make no choice at all, paralyzing them in place as their male peers sprint past them.

**The Importance of Managers**

The best way to get off the fence is to be thrown in, assigned by their manager to a “stretch” position that is sure to increase their skills and exposure. However, managers are also reluctant to do this for female employees, due to similar assumptions about their family lives. This is a difficult needle to thread, since some women do prefer to preserve more time for their families outside of work and it is important to have managers who are willing to accommodate that. However, the general sentiment from women I spoke with was that managers should not preemptively make this decision on women’s behalf. The position should be offered if it is deserved, and then the woman should be given the ability to accept or decline. This is difficult in practice, particularly when managers know a lot of detail about employees’ home lives. They begin to fill in the blanks without checking with their employees first. Janaki caught herself in this position during her company’s unconscious bias role play. She was given a mock scenario in which she had to send an employee on a business trip overseas and she had a decision over whether to send a woman with a small child at home, or a man. Without thinking, she chose the man, worrying that her female employee would have to figure out what to do for childcare. She reflects on her mistake:

“I thought, I’ll just send the man, it’s easier. But I should have let the woman have the choice! Maybe she could arrange for daycare, maybe she could take her kid with her. But you’re not even offering her that choice. Me! Me! I chose the easy way out!”

Janaki stresses that if even well-meaning female managers are unable to make the right judgment calls in these scenarios, it seems unlikely that male managers will have the foresight to avoid these unconscious biases.
Lifen (F, 29, China) faced a similar scenario with her manager when she had her first child, which was complicated by common workplace stereotypes that Asian women should be docile and obedient. The dual expectations that she should be dedicated to her family and uncomplaining about her work prevented her from the visibility she needs for promotion. Her manager played an important role in shaping these expectations:

“I told my manager, he is a Korean guy. I’m not sure if you know Korean culture or not. Their wives really don’t work. They will quit immediately after they get married. So he just told me, baby is more important. You should become more family oriented. He even told me I encourage you to stop doing the overtime and take a good rest, then come back to work.”

To be fair, Lifen appreciates the sentiment. Being a parent has been difficult and her manager has allowed her extra time off to take care of the baby. However, she is frustrated that she keeps getting denied a promotion. She had done a lot of overtime, in addition to the baby, hoping that would help separate her from the flock. He encouraged her last cycle to request a bump, but it was denied. She was very angry and hurt about this decision. Her manager explained it was because she did not have enough visibility.

Visibility is a sensitive subject for Lifen. She understands why she needs visibility, but she keeps getting dumped “garbage work” that prevents her from doing more high-priority projects. Her efforts to push back have not been successful. Furthermore, when she tries to organize events that upper level managers might notice, they don’t show up. This is a recurring problem for junior engineers. Michael (M, 56, White American), a senior technical engineer, confirms that while anyone can request a meeting, junior employees have a harder time getting people to show up. One of his younger team members from Singapore faced this problem recently. After several no-shows, Michael’s boss told him that he, as the more senior employee, needs to call the meetings from now on so that people would actually attend. Michael clarifies
that different titles mean different things to different people. From his experience, his Asian coworkers hold a great deal of respect for his senior engineer title, rank and experience. On the other hand, his American coworkers care less about titles and more about cultivating a trustworthy reputation. Over their careers as engineers, employees build a reputation for not wasting people’s time, not inviting random people to their meetings without reason, and not insisting people attend unless they have something important to contribute.

Vidya agrees and adds that this applies to all communications in the company, including email and virtual chat conversations. Beyond simply deciding a meeting or email is not worth their time, they may also respond in a less polite way if the employee is junior to them.

“The first thing people look to when you send an email, is they look you up. They look you up and say, “What level is she? Or he?” Am I going to (a) respond? Am I going to respond in a snotty way, or am I going to respond in a polite way? Obviously, it’s what everyone does and level does matter. If I’m the director of such and such, it makes a big difference.”

Lifen is likely being ignored precisely because she ranks so low on the company hierarchy. She has worked very hard to make improvements that would lead to higher visibility. However, she can’t get anyone to help her. She explains this is partially about conflicting team priorities. In order to do her job, she needed to get the other team to help her develop some parameters for a device and send them to the manufacturing floor. But because they did not directly benefit, the other team decided not to bother.

The discourse of productivity resonates throughout each step of this story, as upper level employees justify not attending by reasoning that Lifen’s meeting is not important enough to merit their attention. They are offloading “the inconvenience of other people” (Gregg 2018:91), as justified through the demand to focus their attention only on the most important tasks. Similarly, Lifen is not important enough to merit basic courtesies such as formally declining the
meeting request. We can see the consequences of productivity discourse play out, as the language of efficiency justifies poor treatment of a colleague, and results in her stymied career advancement.

To make matters worse, Lifen’s behavior in trying to get managers to attend also drew negative criticism. The manager who didn’t show up to Lifen’s meeting went to her manager and complained about the way she was hassling him. Her manager sat down with her to discuss how to handle these situations in the future. “My manager told me next time, you just be calm. No rage. Just be nice. Smile. When they do this, you smile.” In what was supposed to be a heart-to-heart moment, her manager cautioned her to hold back her feelings, to be more pragmatic, to work more as a team player. He advised her that in this American system, you have to hide and hedge your ambition, and you have to do things to help other people. He says sometimes you have to do the dirty work, and he advised her to take responsibility for doing whatever it takes to get the job done, including assuming a lot of low-visibility work. From what I learned during my fieldwork, this advice will not help Lifen get a promotion.

Instead, what the manager is accomplishing here is encouraging Lifen to mold herself to expectations of a docile, uncomplaining Asian woman in the workplace. Her efforts to be recognized are seen as attention-seeking and overly-ambitious. Her anger at others’ rude behavior and dumping of “garbage work” is perceived as “not nice”. Let’s recall the bully from Asha’s example, who expresses his anger loudly and publicly and strongly resists taking on “garbage work” himself. His behavior is perceived as “not nice”, but it is rewarded – he succeeds in getting someone else to do the job and experiences little of the negative fall-out. His own emotions are invisible, instead comprehended inversely, through the emotional visibility of his (female) coworkers. In contrast, Lifen has little power to prevent taking on “garbage work”,

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cannot get anyone to invest their time in her work, and is then chastised for experiencing and expressing her anger. Her socialization process at work pushes her toward accepting the low-visibility work no one else wants without complaint, and risks rendering her permanently invisible.

The role of the manager is particularly critical for protecting women’s reputations at work. Mihika (F, 32, India) faced a similar scenario when a senior engineer kept refusing to help her complete one of her critical projects. She kept requesting a simple response from a more senior team member and he would tell her, “It’s not a priority for me right now.” She felt very frustrated that it was such a simple thing, but she could not force him to do it. In this story, we find a similar pattern in which women find themselves becoming the victim of others’ offloading their “unimportant / nonurgent” work. The man does not feel this is important on his list of high priority items, and Mihika is not powerful enough to increase its priority status. As a result, her project stalled while she waited.

Fortunately, both Mihika’s manager and the other man’s manager recognized the problem and took steps to correct it. The man’s manager asked her to come in for a private one-on-one meeting to discuss the man’s obstruction. “He took very serious feedback from me, noted down everything,” Mihika told me. “Why was it difficult to work with this person? Do you think they can improve? Or are they just being stubborn? So they knew there was a problem for sure.” This type of manager intervention is unusual. Mihika was surprised to be called. She knew her manager was aware of the problem and had been keeping her in the loop. But for the other man’s manager to become involved reflects either extreme conscientiousness of the manager or the brazenness of the man’s refusal to complete his part of the work. This intervention meant that the man was forced to do his part of the assignment and Mihika was able to finish the project.
Mihika’s own manager also played a role in shielding her from some of the risk and protecting her career progress:

“It could also reflect badly on you. That you’re not doing enough. Why is there no progress? I guess I was just comforted by the fact that [my manager] agreed that they are difficult people to deal with. [She told me,] ‘You and I understand it’s not easy to deal with them. So I’m not saying you’re doing something wrong or you have to try harder. I know you’re doing the right thing. Sometimes it’s not easy to work with some people.’”

Mihika found this support from her manager comforting, but it is not only Mihika’s feelings that need to be protected – it is her career progress. While many managers may downplay the importance of what may be perceived as minor workplace conflicts, they risk allowing their employees’ reputations to be ruined by events out of their control. Fortunately for Mihika, her manager situates herself as a buffer between Mihika and the intense scrutiny of upper management.

**Domestic Conflicts**

The manager’s role in promotion is also crucial during women’s maternity leave. As in Lifen’s case, many managers assume that women prefer to spend more time with their children and will not recommend them for promotion. They presume that they will not want to do “above and beyond” work after returning from leave and may even start bracing for women to never return at all. As Valeria (F, 34, Hispanic American) pointed out in Chapter 2, some teams will begin offloading women’s projects to other team members, forcing women to fight to get them back when they return. Shuang (F, 31, China) has a friend who was worried she was not going to get a promotion because she unexpectedly became pregnant. She knew she would have to be out on maternity leave during the time when managers would be evaluating who to promote. She felt that her pregnancy was going to hold her back another year from the promotion she felt she
deserved. Mihika also faced this dilemma when she was pregnant with her first child. Thankfully her manager again went to bat for her, securing her promotion prior to her maternity leave.

Furthermore, women’s perceived and actual ties to motherhood prevent their promotion through technical tracks as well. These technical pathways are perhaps more competitive than management roles. They were designed to provide engineers a way to continue to be rewarded for their experience in the company without having to manage people, which many engineers are averse to doing. Not only does “people management” involve a lot of “social” skills that engineers are suspected to be lacking, but managing people is messy, time-consuming, and distracts from technical work. Despite the numerous barriers to women’s promotion on the “people management” track, women are presumed to be a more “natural fit” for management roles expressly because of their experience as mothers. Janaki remarks to me that it is her role as a mother that has made her a better manager – the ability to multitask, resolve conflicts, balance competing deadlines – these are all critical tasks of both motherhood and management. However, as much as she enjoys being a mother and working with people, if she had her own choice, she would choose a technical career path. She has been increasingly frustrated with her managers’ resistance to allowing her to pursue a technical track. She is not alone. Several women I spoke with at lower levels in the company are eyeing a technical track rather than the management track. Unfortunately, high-achieving women are frequently steered up through “people management” pathways. The assumption is that all women want to be promoted and the company’s incentive to demonstrate that women are moving up the chain creates a “push” toward management. Perhaps counter-intuitively, women are invisible while striving for management roles, but once clearly visible as a “high potential”, they are steered away from technical roles. In neither scenario are women fully in control of their careers. This is quite
frustrating for women who prefer to stay on technical tracks. Women’s burden of having to learn social skills as a result of their socialization and subordinate position is turned against them when it is time for them to choose their own career paths.

**Job Hopping and Lateral Moves**

Finally, women’s pathways are punctuated by numerous lateral career moves that set them back years in the promotion cycle. While these moves are sometimes necessary to escape discrimination, resetting one’s experience with a new manager, developing a new reputation and restarting the promotion clock means that for each lateral move, women will lose 1-2 years before they are promoted again. For employees like Carmen (F, 37, Puerto Rico), changing positions was crucial for her survival in the industry. Her manager frequently undermined her and even yelled at her in front of her coworkers. Continuing to work for him was a strain on her mental well-being and a future promotion was clearly out of the question. She considered quitting her job and leaving the company.

[C]: “I’ve never been in a situation like I was before, where I felt like I was literally just disrespected at work. Especially when you are coming in, new to a new company. Plus, all the other stuff that’s going around in my personal life. And then having that happen at work, I was like, ‘I can’t handle. All of this.’ I thought about quitting back then. I really thought, ‘This is a total mistake, I should have not come here. I should have just left.’”

[S: ] “So what did you do?”

[C: ] “Changed jobs. Changed jobs quickly.”

Fortunately, a position had opened up in another department. One of her friends who worked on that team encouraged her to apply. “They needed someone with an [industrial engineering] background to do this job. And basically I just went ahead and applied for it. And got out. I got out.” There is a sense of hauntedness in Carmen’s voice as she tells this story. “I got out. I got out.” As if she cannot fully believe she escaped, as if the trauma of the experience continues to
linger despite now having reached a point of safety. One long-term consequence of experiencing this early career turmoil is that her promotion has stalled.

“Unfortunately, I feel like…after I had my initial promotion four years in, it got stagnant. So basically, from process engineering to [industrial engineering], that was lateral. When I moved from [company] to [company], that was also lateral. And then I got here and basically ended up having to change roles very quickly multiple times. The first role was a disaster. And then when I moved to the technology development role, I had to start from scratch. And then that got dissolved, even though I was doing really good, it got dissolved. So I had to start a brand new role. There was a lot of stagnation. Now that I’m moving back to [my original company], I’m definitely getting a promotion along with a pay increase. [If] I stayed here, I would probably not be in line for a promotion this year because I just got to my role. So I probably would be having to wait another year before a possible promotion.”

After so many lateral moves, Carmen may have trouble being perceived as a “high potential” to future managers. There is a presumed pace for promotion, an expectation that employees will move up once every 2-3 years. Interruptions to that pace make it seem as if there is something “wrong” with the employee, or they lose momentum and stop being considered, making way for new up-and-comers in the company. Or sometimes, employees simply lose the will to continue to seek promotion, as was the case with Carmen.

“At some point in my life I thought I did [want to be a manager]. But as long as I’m dealing with people, I don’t need to manage people. I don’t need that. As long as I can deal with people and talk to people, I don’t need a manager role.”

This shift in attitude is not unusual for engineers who fall off the usual pace of promotion bumps. Once it becomes clear that promotions are unreachable, employees begin to focus on other aspects of their work that are meaningful. In Carmen’s case, she is able to satisfy her desire to work with people by connecting more with her coworkers. However, she does note that changing companies is part of her strategy to force a promotion that was not available at her current company.
Casey (F, 26, White American) has also recognized the importance of leveraging outside employers as a strategy to move out of a stagnant position. She has been stuck at her current level for some time now in a group where promotions are mostly determined by seniority. On the production side of the industry, where patents and publications are less common for helping employees stand out from the crowd, seniority and experience are more important for promotion. As one of the youngest employees in her group, she is discouraged at the idea of having to wait so long for her expertise to be recognized. Instead, she feels the fastest way to a promotion in her area is to leave the company and get experience in a smaller company where there is not as much competition and more opportunity to be promoted. If she wanted to, she could then leverage that experience to negotiate a higher-ranking position by returning to the original company. Unfortunately, the jump between companies is easier said than done. Until she can find another employer willing to hire her, she will have to continue to bide her time on the production floor.

Position hopping between companies comes with considerable risk. Not only are employees jumping almost blindly into a new team with a new manager, with little idea about the team or company culture, but much of one’s personal reputation is lost in the transition. The years that employees have spent establishing their reputation and networks within the company are lost. While the networks may still come in handy for future career moves, their reputations will need to be entirely rebuilt in the new location. While some forms of recognition may follow employees to the new company – for example, patents and publications will remain in the employee’s name – some forms will not be transferrable. In particular, trade secrets, internal company process improvements, and internal awards are essentially value-less in a new environment. Furthermore, transfers between companies are not always one-to-one comparisons. Employees may have to take a pay cut or demotion to get into a company in exchange for the
possibility of increased upward mobility. For example, Mandira (F, 35, India) has been contemplating a move to Silicon Valley in California. Jobs in this area would certainly offer more potential for advancement, but they are actually a step down in job title. Her current job title ranks a little higher in comparison to other companies in the northeastern region, but it would equate to a lower rank at one of these prestigious tech companies, like Facebook, Google or Apple. Therefore, the decision to move to a new company requires a careful consideration of risks and opportunities, while keeping in mind that promotion is not a guarantee.

So far, the job hopping described has been deliberate, but there are also involuntary changes in positions as well. One of Emily’s (F, 34, White American) coworkers suddenly left to join another company, leaving her with the majority of the work to keep the team’s targets on track. Despite landing in a senior technical position managing a team and her workload tripling, she received no formal promotion or pay increase. Although she advocated strongly for hiring more employees to help ease her burden, these requests were denied and she soon found herself overloaded trying to manage daily operations by herself. Although Emily was stressed, she liked her new role and was dismayed when, under the guise of benevolence, her coworkers began reducing her work load, arguing that she was under too much pressure. Since her position had never been formalized by a new job title, her high visibility work was gradually stripped from her agenda and redistributed to other members of the team. To add insult to injury, she did not receive a formal promotion in the next cycle. She was told this was because there were so few promotions to give out and she lacked seniority, but it was hard not to make connections between her team’s perception that she was overstressed, the stripping of her high visibility work, and her diminishing role in the team.

“I definitely felt like I was doing the level of work of somebody who was much more experienced than I was. But I was being stripped of a lot of my most critical work. And it
feels condescending and overreaching for somebody to say, “No, you’re too stressed out.” Well, if I’m performing well and here are my results, then…”

Fortunately, this team eventually dissolved and Emily was assigned to a new team. However, this is a crucial loss for her at a critical time in her career. She had been close to a promotion before, and now she will have to wait another year, possibly two. Furthermore, her resume will never adequately reflect the leadership role she performed on her prior team. Undocumented, it simply vanishes, as if it never happened at all.

Strategic shifts like the one that dismantled Emily’s team are another chasm into which employee forward progress can vanish. For Ilma (F, 40, Pakistan), her team was disbanded due to a strategic change and like Emily, she was shifted to a new group. The change in position was intended to be a life raft. Others in her team had been laid off, but she was offered a soft landing in another group. This was explained as an effort to keep her expertise within the company and she was grateful. However, she struggled to find her niche in the new team. They were so well-established that they had no clear role for her. “I was given as an apprentice to a senior person to stick with them. So I was kind of assisting him, but he was doing everything on his own. So I was like, what to do now?”

This is not altogether uncommon following strategic shifts in engineering industries. Employers see their employees as valuable investments and resist letting go of people they see as having high potential. However, attempts to relocate them within the company are not always an easy fit. Employees will be sent to teams that have been allocated extra resources or could use an extra hand. However, integrating them into the original team can be difficult. Tasks have already been assigned and team members are protective of their own work, so it can be difficult for a new team member to figure out how to contribute. Sometimes, as in Ilma’s case, a clear role
never emerges and engineers spend months doing very little valuable work. Contrary to those who might see this as an opportunity to relax while pulling in a hefty paycheck, having no clear role at work is extremely demoralizing. Ilma felt deflated: “You feel like you’re useless. They’re all doing their own jobs. They do not need me. This sort of feeling. My thing was that, I should not have moved to [this project].” Although this was clearly a setback for Ilma, she was determined to make the best of it. Unfortunately, the new project was also a dead end. A few months later, there was another strategic shift in which the company determined this technology was not worth the investment and terminated the program and all teams associated with it. This came as a shock to Ilma, who had not yet found her feet. As the newest team member, and the least valuable, she was one of the people who was laid off in the second round. She chides herself for her decision to move to the newer, exciting technology:

“I should have moved to [the older technology]! I said no, I don’t want to. There is nothing more to learn…[it] was already established, the most you could be doing is making a new product, doing the same processes, make sure they are run properly. [The newer technology] is exciting, something new. But in terms of job wise, [the older technology] is twice more stable.”

In this example, it is clear that Ilma was affected by her lack of “omniscience” in predicting the best possible career move. Given the limitations of her own perspective on company strategic priorities, she was unable to anticipate that the newer technology was in danger of folding. As a result, her career was critically injured, resulting in months of work on a dead end product and nearly a year out of work, searching for a job in a flooded market. She had been hoping for a management role one day, but she feels discouraged about her possibilities. She had originally been impressed upon moving to the U.S. at the number of Asian executives; in the U.K., she did not see any Asian managers at all. However, she feels structurally isolated with few network connections in the U.S., making it difficult for her to navigate a promotion. These factors
combined with the recent bad luck of her reassignment and layoff set her career back substantially. Eventually she was hired back to the same company and is continuing to pursue a promotion. Although this new position – her third in two years - was a lateral move, she is still hoping for a promotion soon. “It is my 7th year of experience, usually promotions happen at the 8th year,” she explains. However, she lost a year searching for a job, which was a year not spent earning patents or experience at work. While it is commendable that women like Ilma continue to fight and exhibit unending optimism, critical events that result in reorganizations and layoffs can fundamentally change the trajectory of their careers.

Making Their Way Up the Ladder

Less than six months into her new role as a second-line manager, after having her salary increase denied and feeling consistently underappreciated, Janaki (F, 42, India) decided to leave the company. Her husband was offered a position at another company and as a part of his benefit package, they have offered to find her a position as well. The new company came up with a list of four possible research projects for her to lead, all of which she found interesting. The decision was difficult, but it seems to make the most sense. The new job is an opportunity to get back to technical work that she enjoys more than managerial work. Furthermore, she can build new networks, which may actually end up being an advantage over having exclusively internal networks within her current company.

However, despite her excitement at the new opportunities on the horizon, Janaki feels this is a real sacrifice - she is giving up all of the work she has invested into a single company over her entire career. She has never worked anywhere else. She invested significant resources in building her internal network but has very few connections outside of it. Now, she will have to leave all of that social capital behind. Her patents, her titles, her accomplishments will all be left
behind. She will have to build her reputation all over again at the new company. It is a phenomenal opportunity, but it does disrupt her career, and it is clear that her gender is an important factor in her career trajectory. If she had not been continuously undermined at work, if she had been offered a technical position she clearly requested, if she was not the spouse of another engineer looking to make a career change…where might her career have taken her if she had been able to steer her career the way she chose? Such losses dot the pages of so many women’s stories in engineering.

Still, several of the women who do finally manage to break into leadership roles remember the struggles they faced on the way up the promotion ladder and use the power they have to rectify inequalities. While Vidya (F, 44, Indian American) notes that many women become more competitive at the top, wielding discourses of productivity to justify undermining others, she personally strives to find an alternate way of thriving in upper management. Utilizing accepted discourses of women’s solidarity, she looks down the chain of management for other women of “high potential” to pull up after her. When she hears of positions that open up in the company, she consults the list she keeps in her desk drawer. She has served as a mentor to help develop women’s career growth. Some “high potentials” don’t need extra help, she tells me. “They play the game well on their own, they are already on the high-profile projects, they are determined to navigate their own path. For those people, you just get out of their way and allow them to rise.” However, Vidya knows from her own personal experience that some “high potentials” are more difficult to recognize because they don’t yet know how to speak up for themselves. “They are shy,” she says, “they don’t reach out.” She is on the alert for these women. This is an act of paying it forward for Vidya. She asserts that she would never have gotten to where she was had someone not pulled her up. She thinks that for some employees,
especially female employees, you have to show them how to play the game, the way that someone once showed her. This form of solidarity with women at all levels and across all departments within a company has the power to open up new channels to women that have previously been unavailable. A few of these possibilities are explored in further depth in the next chapter.

**Conclusion**

The process of achieving a promotion for women is a difficult path. They experience all the same struggles as their male peers on their way to the top - taking on “above and beyond” projects, learning the discipline of productivity, molding their personalities to suit the cultural norms of leadership traits - plus additional obstacles along the way. The “in/visibility paradox” in the promotion cycle means that they are highly visible as having the “social” skills needed for middle management, while simultaneously battling the tendency to be assigned to non-technical, non-visible, low priority tasks. While women are commonly seen as “naturally” good at managing people, they have difficulty negotiating the relational promotion ladder due to their lack of recognition as “high potential” employees. Furthermore, women’s career pathways are punctuated with career breaks and lateral moves that deviate from the preferred timeframe of promotion. Some of these disjointed career moves are connected with their role in the family as mothers and caregivers, while others are related to escaping managers and teams that inhibit their career growth.

I have highlighted in particular, the ways in which the discipline of productivity is a technique of power, shaping individuals to conform to expected norms of behavior on their way to the top of the management hierarchy. In this American management style, with its numerous levels of management and subsequently increased opportunities for leadership roles, promotion
is the carrot by which institutions persuade employees to discipline themselves to greater levels of productivity, greater alignment with corporate strategy, and an emphasis on self-interest over community. However, following Foucauldian understandings of discipline, power does not exist without resistance – wherever one finds disciplining forces, there will be evidence of acts of resistance, no matter how small.

Some engineers, both men and women, are uncomfortable with the conflict and overt ambition of the promotion track, choosing instead a strategy of withdrawal - they simply “go with the flow” and attempt to avoid playing the promotion game at all. Farhan (M, 32, India) describes his strategy to me: “I just do my thing. Some people say I’m in my own world, but I’m just into my work.” Janaki has used this strategy as well: “I try to stay out of the rat race,” she says, explaining her dislike for the hyper-competitive culture of management circles. She tried to play that game for a while, but it only created more stress for her. Now, she simply tries to do her best work, while taking good care of her family, and allows everything else to work itself out. This strategy relies on a faith in meritocracy, that those with good skills and good work ethic will inevitably rise to the top.

Other engineers have downgraded their expectations of promotion after learning the rigorous requirements, often taking themselves completely off the promotion track. Shuang (F, 31, China) and I, driving back to work after having lunch out, discussed the tradeoffs of seeking promotions in the company. She is not sure she wants to pursue a promotion at the moment. She has just gotten married and is thinking about having children soon. She’s not sure if this is the moment to be taking on “above and beyond” work. This was a common uncertainty for many employees. Despite their desire to “succeed” along the normative career path, faced with the prospect of packing additional work on top their normal workload, many ultimately decide they
are not willing to make such sacrifices and set alternative goals for their lives that do not revolve around promotion and success at work. It is this effort of finding meaning, community and belonging outside of work that is the subject of the next chapter.
CHAPTER VI
Flexible Selves

On one beautiful, warm evening in late summer close to the end of my fieldwork, I conducted a home visit with Ravishankar (M, 44, India), a computer engineer with a special focus in semiconductor manufacturing applications. His family had recently been blueberry picking at a local farm and brought home over 40 pounds of blueberries. What does a single family do with 40 pounds of blueberries? They weren’t really sure, but they were trying to eat them before they go bad, so I sat at the kitchen table eating blueberries with a spoon like cereal while Ravi told me about his bucket list. Gesturing toward the sliding glass doors, he explained that he had been meaning to fix his deck for years, but it kept getting pushed off. He had recently finally decided to bite the bullet and hire a contractor – a man who has provided construction services for many people in the Indian community – to tear out the old deck and replace it. As I gazed out the window, I saw that the deck was completely gone, with just a patch of bare dirt where it once stood. Ravi confided that he had been postponing things on his bucket list for quite a while and he felt unsettled with the length of the list and how it keeps growing.

And it wasn’t just home improvements – another item on the list was to take a cruise with his family. Many of his friends in the Indian community have been on cruises, but he had never been. They brought back photos and swapped stories about their experiences and how much fun they had. In these conversations, Ravi felt like he had nothing to say. He and his family have prioritized taking yearly trips to his hometown in India instead, which uses up all of his vacation time. He also dreaded the cost of the cruise and wasn’t sure whether he would actually enjoy the party scene. But he felt this was an important thing to check off the list, just to say he had done it, and perhaps he would then have a few stories to share with his friends. This year, he and his family have decided to take a vacation along the southeastern coast of the US to visit a couple...
popular beaches. It’s not a cruise, but it would be less expensive and located in the US. His kids were excited at the idea of a “normal” American vacation and he hoped this would give him some good stories to share with his friends when they got back.

The bucket list, for Ravi, was an expression of a deeper feeling of unsettledness about the trajectory of his life. He spent his early career working remotely from various locations in North America, coordinating with offices across the US, India, China and Germany. This meant he had conference calls at odd hours of the day and spent many long evenings glued to his computer in his office. In our conversations, he often decried the intensifying productivity-oriented lifestyles that he saw emerging in the Indian community around him and felt there must be more to life than work. In the past few years he has been trying to find fulfillment in other ways: community service, running marathons, and spending more time with his kids. He has decided to intentionally devote more time to non-work aspects of his life and is seriously reassessing whether he wants to go for a promotion, knowing that it will mean longer hours and less flexibility.

In her study of Indian IT workers in Berlin, Amrute (2016) argues that Indian IT workers’ leisure activities constitute a form of resistance to the continuous expansion of work life into home life. Caught between the “cruel optimism” (Berlant 2011) of the unrequited promise of fulfillment through work and the “imagined critical utopias” (Weeks 2014) of an alternative to life in the transnational labor market, workers enact resistance through taking pleasure in their lives outside of work. Although Amrute focuses on strategies within the Indian IT community, I noticed this phenomenon at work in the lives of most of my participants, across race, gender and nationality lines.
Gregg (2018) argues that these “someday lists” are an extension of productivity discourses. As employees tightly manage their time and energy at work, these practices bleed into their home lives as well. Through processes of list-making and prioritizing, employees justify the neglect of tasks that are judged to be “unimportant” or “nonurgent”, such as doctor’s visits, hobbies, and vacations. Such luxuries are postponed for an imagined time in the future, envisioned as rewards for effective self-discipline. However, as Ravi was beginning to notice, this imagined future keeps getting deferred and the list grows ever longer. Eventually, he begins to wonder if these activities will ever take place at all. The “someday list”, rather than its intended purpose as a motivator, becomes a source of guilt, a reminder of things that one has not prioritized and may never accomplish.

Foucault would refer to the discipline of productivity as a “self-technology”, or an exercise of power that coerces individuals to perform “operations on their own bodies, on their own souls, on their own conduct, and in this manner to transform themselves, to modify themselves, or to attain a certain state of perfection” (Foucault 2016:25). Productivity, as I discussed in Chp 5, is one of several cultivated mindsets in US engineering culture, along with meritocracy and individualism, that are crucial for acceptance amongst one’s coworkers. Through participation in the workplace, employees are encouraged to place the company’s most urgent needs and priorities first, to have faith in meritocratic and individualistic utopias of success, and to disregard relationships with their coworkers as “unimportant”, “non urgent”, and ancillary to their sense of fulfillment at work. Engineers, in particular, as experts in efficiency, enthusiastically embrace the techniques of productivity, transforming themselves willingly into hyper-efficient executors of tasks.
In the workplace, difference often means inefficiency, and it is something that must be minimized for a smoother workflow. Whether by gender or race or ethnicity, engineers who are members of a minority group learn to submerge the parts of themselves that do not fit, attempting to find outlets for them outside of work where they are not disruptive. Similarly, expressions of dissatisfaction or accusations of discrimination are also inefficient – they create conflict and take time away from profitable work. Instead, employees place their faith in meritocracy, which promises that if an employee works hard, they will eventually be rewarded. Although many employees understand that the system is unequal, and often unfair, meritocracy is a convenient myth, which enables employees to continue to function within the system.

The payoff for this self-discipline is membership, and beyond that, the promise of a utopian future, in which there is plenty of time for leisure, in which one feels one has lived a fulfilling life. The “bucket list”, in this sense, is a way of making this utopia concrete. It is a list of possessions, activities, and experiences that employees feel would produce a meaningful life. The tragedy is that it is a list of things they often cannot find time for. Their guilt over the length of their list is, in this sense, an internalization of the losses sustained as a result of the self-disciplinary techniques of productivity.

Despite the discourses of individualism that pervade contemporary American working life, philosopher Levinas (1994) insisted that we exist not solely as individuals, but that our subjectivities are founded in relation others. Although the sustained cultivation of individualistic self-interest is a necessary practice in contemporary workplaces, the need for belonging makes itself known persistently, in moments of quiet isolation, moments of painful discrimination and alienation, and in the constant insistence that fulfillment through work and economic success is not enough. In addition, Levinas contends that our responsibilities to others are not optional, but
foundational to our sense of meaning, purpose, and direction. Building on this work, Gammeltoft
(2014) similarly critiques liberal tendencies to treat individual freedoms as the most salient
human need, arguing that belonging is a fundamental necessity of human existence. Belonging
can thus be viewed as a social achievement, carrying obligations to others that are of great
significance; it is a condition which is fragile, contingent, and temporary, always accompanied
by the threat of its disappearance.

In the multicultural world of semiconductor engineering, many employees feel as if they
don’t really belong anywhere. The participants in this study do not fit neatly into pre-determined
social categories. They feel as if they are ‘misfits’ in any group along one criteria or another,
whether through demographic classifications like race or gender, or through less predictable
criteria, such as Ravi’s friends’ cruise vacations. It has been suggested that belonging has two
interlocking components: (1) a need to feel accepted as a member of the group, and (2) a need
feel valued for one’s uniqueness and authenticity (Jansen et al. 2014; Shore et al. 2011). For
most participants in this study, these criteria cannot be met within a single group, and therefore a
sense of belonging is pieced together between multiple groups. As a result, their lives become a
fragmented experience.

To a certain extent, this fragmentation may only be experienced as problematic in
contexts in which a fixed, “authentic self” is expected. Kondo (2009) argues that a relational
concept of selfhood, often suppressed in Western cultures, enables discontinuity and changing
selfhood over time and in different contexts. This can be particularly beneficial for those who
exist on the “borderlands” of multiple identities. Poet Anzaldua (1999) coined the term la
facultad to signify a heightened sensitivity, or a sixth sense, of one’s own position in relation to
others. The intuition of la facultad is particularly well-developed amongst women of color and
those who exist on the margins of multiple axes of inequality, for whom the rules of belonging are complicated by intersectional contradictions of perceived appropriate behavior. This sixth sense is both a gift and a burden; it delivers the superpowers of political sensitivity and maneuverability, but it is born out of the pain of repeated chastisement for stepping outside the invisible boundaries of social relations of power. By embracing relational selfhood, it may be possible to reduce the pressure to produce a fixed or stable “authentic self”, enabling the sanctioned fragmentation, variability and flexibility depending upon the context.

Given the sacrifices that are required in the workplace through self-technologies and the submersion of conflicting identities and relationships, employees turn to external groups to fulfill their need for belonging. Ethnic and religious communities become important “third spaces” in which individuals reconnect to traditional identities and negotiate hybridized identities (Nicholls 2014; Bhabha 2012; Hollinshead 2004). Hobbies such as marathon running, exercise, and yoga become avenues for connecting with American lifestyles and often become metaphors for the importance of leisure for personal happiness. Although women struggle to belong amongst women who are not engineers, they can find purpose and solidarity within communities specifically for female engineers. These organizations become spaces in which women engineers can find an outlet for feminine expressions of their personalities, find community with other women on the margins of a male-dominated career and critique the structures of power they are embedded within.

Gammeltoft (2014) reminds us that any achievement of belonging also inherently involves a sense of loss: opportunities not taken, sacrifices made, potential selves that will never come into being. In exchange for an exciting transnational life on the “bleeding edge” of semiconductor technology, employees have sacrificed some of the common modes of belonging,
through kinship, regional community, and national identity. These elements are not neatly extracted, nor easily abandoned. Most require careful management, constant reassessment, and exact a steep price of guilt and suffering. Semiconductor employees navigate separations from their families and maintenance of their ethnic identities according to their own logics.

In this chapter, I show engineers’ efforts to mitigate the losses they have experienced as a result of their achieved belonging on the integrated circuit. I identify the ways in which they create communities of belonging and generate avenues of meaning and purpose outside of work. Finally, I demonstrate how they have made peace with feelings of nonbelonging, learning to view their position on the margins as a strength rather than a weakness. Berlant has argued that the emerging “global precariat” in the professional band has harnessed their own personal flexibility to create “networks of shared obligation that seem more grounded and permanent than the corporation will support structurally” (Berlant 2011:218). Engineers on the integrated circuit have embraced a new flexible selfhood to repair the fabrics of belonging that have been strained by distance and time.

**Mitigating Losses**

Becoming a member of a community working on the leading edge of semiconductor technology comes with many perks, including high salaries, good benefits, and exciting work that, in many ways, does indeed fulfill its promises of changing the world. Working abroad offers unexpected opportunities, financial rewards, and multicultural experiences. These are highly prestigious careers – overseas travel and long-term work abroad are enviable amenities coveted by many engineers on the integrated circuit. However, accepting a position in the integrated circuit requires a sacrifice of membership in other communities. Every achievement of belonging is accompanied by a loss of belonging somewhere else. Every inclusion involves an
exclusion. Every decision made produces a path not taken. In this section, I outline migrant
engineers’ efforts to mitigate the losses of kinship and traditional communities to produce new,
hybridized identities on the integrated circuit.

Families

One of the most central nodes of belonging is kinship. Although there is wide variation in
the structures and functions of family, in most human societies, the family is the first circle of
community, the first place where individuals find shelter, safety, and support. Anthropologists
have long studied families as central units upon which wider communities are built. Cross-
culturally, one’s position in the family was a crucial component of one’s position in society.
Early anthropologists Fortes (1987) and Evans-Pritchard (1958; 1933) studying African
societies, show that family status, along with gender and birth order, were linked to one’s social
role and prestige in the community. Similarly, in the Hindu caste system, jatis were job
functions, such as farming or civil service, assigned to family lineages that regulated exchanges
of food, marriage, and important religious customs and beliefs (Kumar 2012:216). Industrialization has weakened family structures, enabling social mobility for some, while
further entrenching and intensifying wealth disparities between social classes. Twentieth-century
globalization has further strained families, with increasing numbers of young adults migrating to
cities or internationally in search of employment. In 2015, approximately 13.7% of the world’s
population were either internal or international immigrants (WEF 2017). Causes of migration
varies: economic opportunity is one factor, however involuntary migration due to political
conflicts and environmental degradation are also major drivers of immigration (WEF 2017). In

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1 Kumar argues that jatis were less fixed than previously reported, and that this fixity continues to erode in the era of
globalized labor.
the United States, over 15% of the population moved between 2010 and 2012, of which over 40% were young adults moving within the labor market (US Census Bureau 2012).

The increasing frequency of leaving home for employment does little to diminish its difficulty. Leaving one’s family behind is often a sorrowful and heart-wrenching process. It severs connections between an identity as a member of the family, and creates a new self, separate from familial ties. The absence of family nearby is one of the most frequently cited losses experienced by migrant engineers in the integrated circuit. Family is acutely missed at times of great joy and great sorrow - weddings, funerals, illnesses, and births of children. However, working abroad in the 21st century does not necessarily mean a complete or permanent separation, as it has for past generations of migrant workers. The emergence of information and communication technologies (ICTs) - including the very electronic devices that semiconductor engineers help produce - have resulted in a new opportunities for enabling long-distance family connections. In what Diminescu has called “the age of the connected migrant” (2008:568), migrant families keep in contact with their loved ones and produce new practices of kinship despite long-term separations (Pham and Lim 2016; Kaur and Shruti 2016; Baldassar et al. 2016).

Most of my participants kept in regular contact with family overseas using Skype, phone calls and text messages, usually multiple times a week, sometimes daily. The purpose of the phone calls is not only to maintain connections between themselves and their parents and extended family, but also to establish new relationships between children and grandparents, aunts and uncles, and other family and friends. During one of our visits, Devayan’s (F, 46, Malaysia) mother called via Skype and he handed me the iPhone so I could say a quick hello on video. She did not speak much English, but they had told her about my visits and my research, and in some
small way, our friendship was comforting to her as evidence that although her son was far from home, he and his family were living fulfilling and successful lives. His mother and sisters called most evenings, Devayan explained to me, not only to keep in touch with him, but to get to know their grandson. “They only want to talk to [my son]!” Devayan laughed. “They don’t care about us!” Nurturing long-distance relationships is difficult and requires extensive time commitment - in some instances up to an hour a day - but families on the integrated circuit make it a priority, despite the demands of work. It is remarkable that the devices that these engineers design and manufacture in the semiconductor industry enable the continuity of their relationships with their families overseas.

International travel has become more accessible for the professional class, enabling additional opportunities for visits with extended family. In particular, new forms of “transnational grandparenting” have emerged that facilitate multi-generational kinship (Wyss and Nedelcu 2018; Hennegan, Redshaw, and Kruske 2015; Xie and Xia 2011; Lie 2010; Baldassar 2007b; Treas and Mazumdar 2004; Da 2003; Plaza 2000). Frequently both sets of grandparents visit on dates surrounding the birth of a child to help the couple care for a new baby in the household. Particularly for young families expecting their first child, parents of the father and mother often visit separately and consecutively to make sure that the new family has support in the final months of pregnancy and throughout most of the first year of parenthood. Kilkey and Merla (2014) have noted the importance of the immigration system in enabling or restricting the possibilities for grandparents’ visits. Indeed, the timing of the visit is carefully selected to comply with visa expirations. In the U.S., grandparents may apply on tourist visas to stay for up to six months. While the length of time between renewals is not clearly specified on the US Travel website, it is generally accepted that at least 6 months must lapse between trips.
I have had the privilege of observing several instances of transnational grandparenting amongst my friends and research participants. Omala (F, 33, India) had a new baby at home during the course of my research, and her in-laws stayed with her for the full six months allowable. Her husband’s parents had been in the U.S. visiting her sister-in-law when they learned she was pregnant. They immediately traveled to New York to help her prepare. Particularly since Omala’s husband was away on extended business travel, they felt it was important to be there to support her. Omala’s in-laws stayed until their original visa ran out, then her parents came a week before the expected birth date so they could be present at the birth and stayed for the first three months to help with the new baby.

Kalpana’s (F, 30, India) family also carefully planned their travel to maximize the length of time they could stay to help out. Her mother and father timed their arrival for two weeks prior to her due date, hoping that she would not deliver early and they could be present. It is difficult to predict travel dates, since birth dates are unpredictable and the total length of stay is not confirmed until travelers go through customs. However, Kalpana’s parents planned to stay for as long as they could.

These extended visits made by grandparents at the birth of their grandchildren has become a contemporary kinship ritual that is not only a practical necessity, but is an important emotional foundation (Baldassar 2007b). Of course, there are practical reasons for the visit - new parents are nervous about the demands of a new baby and grateful for the help of their parents during the transition. Particularly for mothers planning to return to work, having an in-home caregiver during the first year of the child’s life when they need the most intensive care is extremely helpful. However, there is a dual function in this ritual, in that the first few months of caregiving enables an important element of forging an emotional bond between parents,
grandparents, and new children. It allows the grandparents to be present at the birth of their
grandchildren, an important rite of passage for babies, parents and grandparents alike. During
these first few months, the family collects photographs and stories that they will tell and retell, in
their communities at home and abroad, in their future conversations over Skype, and in their
future visits either in the U.S. or abroad. These stories help to cement the grandparents’ presence
in the child’s life, proof of their physical presence and emotional investment from an early age.
These important experiences provide a foundation from which to build upon, parenting and
grandparenting across great distances.

In addition, migrants engage in a range of diasporic tourism, including return visits home
and travel to religious pilgrimage sites (Nicholls 2014; Coles and Timothy 2004; Nguyen and
King 2004). Many of my research participants go to great expense to travel home every year to
strengthen their relationships with their families. Although professional migrants can often afford
the luxury of intermittent international travel, it is nonetheless expensive to fly an entire family
overseas, and it simultaneously drains their accrued vacation time. Some engineers like Ravi (M,
44, India) choose to use most of their vacation on trips home, sacrificing other types of vacation
experiences, and potentially leaving them feeling out of place amongst their friends and
coworkers. However, these trips have been important for him and his wife, who feel it is
important to maintain their connections to India and their cultural traditions. They cultivate
strong friendships within the regional Hindu Temple Society, maintain traditional puja rituals at
home, and their children speak their native languages, Tamil and Telugu. Trips to India every
year enable them to maintain relationships with their families and teach their sons about Indian
culture and traditions.
Frequent return trips also allow Ravi to demonstrate his sense of responsibility and care for his parents, establishing himself as a “good son”. Although carework in migrant families tends to focus upon care from parents to migrant children and grandchildren, this neglects the direction of care from migrants for their aging family members (Baldassar 2007a). Illness and deaths in the family are often moments when the loss of family connections are felt most strongly. Leena (F, 41, India) describes the death of her father as a traumatic moment in her life, which came right at a critical point in her publishing and promotion at work. She sacrificed a first-author paper and a promotion to travel home to be with him while he was ill. “Nothing is worth a paper, my company knows that,” she says. Many of my participants confide their fears about their parents falling ill while they are working abroad. Despite her enthusiasm for living her life on the global circuit, fears about her parents wellness haunt Shuang (F, 31, China). They are healthy now, she says, so working in the U.S. is okay. But if they were to get sick, she would probably re-evaluate whether she wants to stay here. Devayan also considers returning to Malaysia for his retirement. While he feels the education system and opportunities for his son are better in the U.S., he worries about his parents as they grow older. He feels he will eventually want to retire in Malaysia so he can provide care for them in person.

Finally, return trips help to reinforce their dedication to home communities, to whom migrants still retain obligations as ongoing, if currently absent, members (Baldassar 2007b). Migrant employees must negotiate tensions between their transnational identities as engineers on the global circuit and their identities as community members back home carefully. Despite widespread enthusiasm for engineering and IT work abroad, there is considerable resentment from families who have been left behind who feel they have been forgotten. During my trip to India this winter, one tour guide expressed her frustration with the trend toward working in the
U.S., feeling that she had been left behind without this opportunity. “Everyone has at least one family member living in America these days,” she tells me, a bit resentfully. “I used to be very upset about it, that I never had the opportunity to go. But now I am grateful that I never left.”

She found contentment by steeping her life in Indian history and traditions in her hometown, forging new beliefs in the superiority of Indian cultural knowledge as a form of resistance to Western power. Ravi’s determination to travel home each year is, in part, a response to these sentiments, ameliorating concerns that he has abandoned his family, his country, and his traditions through investment of his time, money and energy in these trips.

Not all migrant engineers choose to devote their vacation time so singularly to visit their extended family. Shuang (F, 31, China), a young Chinese woman, prioritizes world travel over maintaining her cultural traditions. While she and her husband try to go home every year, they stay for a shorter period of time and usually append an additional vacation abroad. Last year they stopped Paris in a week-long detour on their way back to the U.S. from China. Shuang wants to take advantage of her life on the integrated circuit and see as much of the world as she can, because she knows she may not be able to do as much when she and her husband decide to have children.

For others, travel is more difficult due to immigration bureaucracy and international political tensions (Kilkey and Merla 2014). Xiaoli (F, 35, China) and her family are very wary of the political tension between the U.S. and China. The two nations are particularly sensitive to information leakage in the semiconductor industry, which result in not only business risks of stolen propriety information but also national security risks (Chu 2013). During the time of my research, political tensions had also been escalating during the Trump Administration trade wars. Xiaoli’s husband has been back to visit family in China, but she had not visited since moving to
the U.S. several years ago. In fact, her second child had never met her grandparents in person. Xiaoli decided this year was the year she would go home for vacation. She was nervous about getting stopped by customs officials, but fortunately, she had no trouble at the border and she returned from her trip to China glowing and full of good news about her family reunion. Xiaoli’s trip home occurred prior to the pandemic of 2019-20, before the escalation of American hostility toward the Chinese in the context of the novel coronavirus. After the pandemic, nearly all international travel slowed to a trickle and East Asians were targeted with increased scrutiny in customs. It was fortunate that Xiaoli’s trip occurred earlier in the year, since if she had left the country this year, there is a good chance she would not have been allowed to return. The tension between the U.S. and China creates additional contingencies that Chinese engineers must carefully navigate.

**Maintaining Traditional Identities**

Family bonds are not the only node of belonging that is sacrificed, or at least modified, for engineers in the integrated circuit – there is also a sense of belonging that comes with national, ethnic and/or religious identity that shifts when workers travel abroad\(^2\). Migrant engineers varied in their expression of traditional identities. Some still strongly identified with the culture of their birth, while others felt less tied to the identities they left behind and preferred to be seen simply as Americans. Most develop “hybridized identities” (Hollinshead 2004), a complex balance between traditions from their place of origin and U.S. culture. Bhabha (2012) has argued that in the “halfway locations of culture” occupied by migrants seeking to maintain traditional identities abroad, the process of reproducing traditional cultures relies on nostalgic

\(^2\) It is hard to separate the distinctions between national, ethnic and religious identity, as most participants sit at a particular intersection of all three. I therefore choose to use the word “traditional” as an imperfect approximation of identities associated with their place of origin.
imaginary and idealized forms of the place of origin. Diasporic cultural productions are therefore never fixed, but constantly in a state of reinvention and reinterpretation (Hollinshead 2004), requiring significant investments of energy into identity production and reproduction (Morgan and Pritchard 2004).

Although the desire to hold onto cultural traditions is most pronounced in families who were born abroad, second-generation Americans like Vidya (F, 44, Indian American), who spent most of her childhood in the U.S., seeks to balance her Indian identity with her American identity. When she met her husband as a teenager, she was envious of his family’s celebration of Christmas. “I loved the idea of having the tree, and the dinner, and the presents,” she reflects. She cajoled her own family until they at least put up a Christmas tree. Now, as an adult, she dreams of one day hosting a big Diwali party and inviting her American friends to share her culture. “Christmas is a holiday that everyone recognizes,” she tells me. “No one has to remind each other that Christmas is coming. Whereas no one knows Diwali is happening unless you’re Indian.” Her statement reflects a sense of loss inherent to existence between cultures. In India, Diwali is one of the biggest holidays of the year, the Festival of Lights, in which the entire country would put on their best outfits, perform traditional puja rituals and attend private or street celebrations. In the U.S., it is barely recognized.

Migrants also craft important aspects of their traditional identities through food choice and preparation, and abstention from particular types of food, such as alcohol or meat (Nicholls 2014). Many of my participants, both men and women, learned to cook when they moved to the U.S. in order to make some of their favorite childhood meals. For Farhan (M, 32, India), food was the thing he missed most about his hometown in Gujarat. The Louisiana town where he attended graduate school did not have Indian restaurants or Asian grocery stores. He learned to
cook on his own, listing this as one of his major accomplishments in grad school. Moving to the Northeast, he was delighted to discover the plethora of Indian restaurants and specialty grocery stores. He is perfecting the art of making biryani, a favorite dish among many South Asian families.

There is a subtle gender distinction in food preparation. While men boast of their cooking skills and show off on special occasions, for women, cooking is a more mundane event, simply part of the everyday maintenance of a healthy household. On a visit to Asha’s (F, 32, India) home one evening, I catch a glimpse of everyday meal preparation. Homemade kidney beans prepared ahead over the weekend when time is not so crunched, rice fluffing in the rice cooker, vegetables quickly sautéed on the stovetop, biscuits made in the microwave in minutes, roti pulled from the freezer. The whole meal is on the table in less than half an hour. These shortcuts enable her to serve healthy food while balancing her full time job and her daughter’s after school activities, including music and swimming lessons.

“Traditional” diets also inform immigrants’ ideas about health and nutrition; many of my participants viewed American diets as fattening and unhealthy and instead focus on using fresh ingredients and recipes from home. Michelle (F, 44, Indonesia) and Daniel (M, 45, Indonesia) rely heavily on Indonesian-inspired vegetable-laden meals that are quick and easy to make on a weeknight. Making dinner is a family affair in this household. Daniel is in charge of the meat preparation; he grills a large batch over the weekend and reheats it throughout the week. He also frequently prepares a side dish of mixed vegetables or “Chinese spaghetti” (spaghetti noodles with soy sauce and sautéed vegetables) to be warmed in the oven. Meanwhile, Michelle chops vegetables, fish balls, and tofu for miso soup and rolls up homemade spring rolls. Their daughter,
Irene (F, 16, Indonesian-American), uses family meal prep to make giant salads for herself and her father to take for lunch the next day.

Kalpana (F, 30, India) and Chetan (M, 30, India) are a younger couple without children who came to the U.S. for graduate school. While they ate American fast food through grad school, they have switched to a more traditional diet after facing health problems. Lentils, rice, and vegetables form the basis of their meals now. Kalpana does most of her cooking on the weekends, preparing beans and curries ahead of time and reheating them throughout the week. She likes to make roti by hand, she feels it is healthier, but sometimes she is pressed for time and will purchase the frozen kind. Sometimes when Chetan is traveling for work Kalpana will still pick up Chipotle on the way home, but she tries more these days to make her own meals. She and many other of my participants struggled with finding foods they consider to be healthy in the American style cafeterias at work, where meals are typically heavy in meat and refined carbohydrates and drowning in oil and cheese. The general practice among immigrant employees is to bring their own lunch, or if it’s necessary to eat at work, to stick mostly to the salad bar. While ideas about what is “healthy” vary widely by cultural background, the return to “traditional” diets generally facilitates eating less meat, more vegetables and less processed food.

Food also is a vehicle for forging connections across cultures. On the multiple occasions I visited Devayan (M, 46, Malaysia) and his family, they introduced me to foods from the three cultural traditions that intermingle in his hometown - Indian, Chinese, and Malaysian. On a typical visit, he and his wife labor side by side over the stove, the smell of sizzling chilis wafting through the air, as I sip cardamom chai on the couch and watch their son play the tabala, an Indian drum set. They proudly present specialty ingredients that are not found in the Asian grocery stores here: fresh anchovies, sent from Malaysia by his sister, fried until they are crispy
and a bright pink rose syrup drink with green grass jelly cubes floating on top. As we eat, they
tell me stories of their lives in Malaysia: the snakes that lived on the roof of their house, the long
bridge Devayan used to take in to Singapore for work every day, the headaches he developed as
a result of the stress of the job, his love of Bob Marley’s music. The meals become an
opportunity for the family to develop friendships across cultures, using food as a language
through which their lives can be more easily translated.

**Integrating American Culture**

At the same time as engineers cultivate traditional identities, they also enthusiastically
adopt aspects of American culture. In particular American civil liberties, human rights, workers
rights, anti-discrimination laws and freedom of the press leave workers with the general
impression that there is more freedom and more opportunity in the U.S. Durriya (F, 29, India), a
Muslim woman who would have been expected to dress conservatively if she had stayed in
India, likes the personal freedom she feels being able to go out for a run on her own. “You can
wear shorts here, no one cares!” she crows, jubilantly. For Shuang (F, 31, China), freedom
means the freedom of career choice. “I think here students have more freedom to choose their
life, their major. It’s just a different culture,” she tells me. In China, she had felt pressured to
pursue a practical career, which is what resulted in her choice of engineering. Now in the U.S.,
she is inspired by the range of career possibilities she encounters. She has considered changing to
a career in health and fitness, entrepreneurship, or consulting. However, as an immigrant, career
changes are not so simple. Until her green card comes through, she will have to continue to work
for a company that can sponsor her visa.

The experience of living in a new culture makes returning home difficult. Devayan
worries about what might happen if he has to return to Malaysia due to loss of employment or
nonrenewal of his visa. He frequently remarks that workplace practices are much stricter in Singapore, where he has previously worked; the hours are much longer and the pace is much faster. He would prefer not to return to that rigid workplace culture. Furthermore, there is a sense of some capacity that has been lost in his transfer to a new location. “I don’t feel that sense of belonging in Malaysia anymore,” he tells me. “When I go back, it’s different for me. The things I do [in the semiconductor industry], they’re different than what people do there.” Although he would eventually like to return, he struggles with this choice since he knows it will never be the same as it was before. He has changed, and Malaysia has changed without him.

Vidya has experienced this sense of non-belonging on multiple occasions in her lifetime. Her parents tried to move back to India permanently when she was young, but the family had a hard time adjusting and they eventually moved back to the U.S. Later, as an adult, she and her family lived in Europe for several years, where she learned the strangeness of coming home after living abroad. “When I was in Germany, I wasn’t German. I was considered American. But then I come back to America and it’s like, they’ve lived in Europe, they’re a little bit bougie. So you don’t quite fit right in, because the world moved on. You weren’t a part of it.” Thus, even with the continued cultivation of traditional identities overseas, through mediums such as long-distance conversations, travel and food, it is still not quite enough to make up for the loss of time spent away and the changes that immigrants undergo as a result of their participation in global networks.

Finding Community and Fulfillment

Life on the integrated circuit has many benefits, such as high salaries, technical prestige, exciting work and status as a global citizen with a broad understanding of the world. However, becoming a member requires sacrificing many of the traditional modes of belonging that are
essential for feeling connected, supported, and stable, such as families and hometown communities. To replace what has been lost, participants try to recreate communities and forge new networks of belonging in their new homes abroad.

**Cultivating Traditional Communities Abroad**

Many transnational employees find community through religious and/or ethnic groups in the region. For ethnic groups with large populations in the area, community centers create a sense of belonging for immigrants working abroad. These “third spaces” are locations that enable the diaspora to perform their collective memory and forge identities in connection to their traditional cultures (Nicholls 2014; Hollinshead 2004). In addition to providing community events and a space to practice cultural traditions such as dance and music, these centers also are opportunities for networking with others in the community outside the semiconductor industry and developing friendships unrelated to work. Several of my participants attend the Chinese Cultural Center (CCC), where they celebrate Chinese festivals and where their children take Mandarin lessons on the weekends. On Chinese New Year, I attended a celebration hosted by the CCC at a local concert hall with Wangshu (F, 38, China) and her children. The event featured a number of performances, ranging from traditional regional dances, instruments, and songs to modern Chinese pop groups, martial arts performances, and even a fashion show. Perhaps the most surprising thing to me about this performance was the way the hosts and performers actively engaged the Americans in the audience, intentionally acting as a bridge to inform the local community about Chinese culture. The event was presented in both Mandarin and English, including Chinese native speakers and English speakers as hosts.

The Hindu Cultural Center (HCC) is a popular place to attend Hindu festivals. Each year they put on a vibrant Diwali celebration, as well as a number of other national and regional
holiday celebrations. The Hindu community in this area is large enough that they are able to break into cultural groups for specific regions of India. Each region is encouraged to use the HCC to celebrate important festivals, and the groups rotate each weekend to cook specialty foods from their home state. One weekend, I assisted in meal preparation with the Tamil Speakers group, in which they made regional specialties such as sambar, coconut yogurt rice, and papadum, a thin fried cracker served with a variety of chutneys. The Tamils host a variety of cultural events throughout the year, such as the Tamil New Year (or *Puthandu*) in April and participate in dance festivals featuring dance traditions from each region. For many of my participants, these events are opportunities to teach their children about Indian culture and encourage them to learn traditional dance, singing, and instruments.

For employees from less represented regions of the world, finding communities within one’s ethnic group is more difficult. In this case, religious communities can be important for establishing a sense of belonging. Michelle (F, 44, Indonesia) and Daniel (M, 45, Indonesia) find meaning and community in their Christian church. They volunteer for church ministries on the weekends and Irene, their daughter, has cultivated friendships in the youth group and Bible study classes. For Ilma (F, 40, Pakistan), though she does not identify as a religious person, the local mosque was an important connection to other Muslim families in the area, who are from a wide range of national backgrounds. Although she is one of the few women professionals and feels out of place even there, the community has been important for establishing friendships with other Pakistani families who share her experiences of home and history. Religious participation in both cases shows how friendships can be cultivated across cultures using faith as a bridge.

Occasionally, connections to cultural and religious centers require bridging multiple identities. Devayan felt out of place at the HCC at first since he is from Malaysia, not India.
Although he is from a Hindu family, he does not neatly fit into the regional categories that organize membership at the center. Eventually, he found acceptance among the Tamil Speakers, due to his wife’s family who are Tamil speakers.

Migrant employees are not equally interested in maintaining ties to their religious/ethnic communities. My participants ranged from those who were highly invested and believed it was very important to pass along traditional cultural knowledge, to those who did not feel it was important at all. Several of my participants described themselves as “not very religious” and only attended community events on important occasions. These individuals focused more on cultivating friendships with families they met through work, their kids’ schools, or expat communities, creating smaller networks of friendships to socialize with on the weekends. Asha and Kalpana were both only occasional attendees at the HCC but had cultivated friendships through family and work that they would hang out with on the weekends and travel with on vacation.

Having children sometimes changes the calculus, as migrant parents try to balance how much traditional knowledge they want to teach their children, weighed against possibility that their visa status will change. Parents worry that their children who have never known life outside the U.S. will not be prepared for the culture and lifestyle in their home countries. Faced with the constant threat that they may one day no longer be eligible to work in the U.S., preparing their children for an eventual return to their nation of origin is a practical approach to adapting to uncertainty. In particular, parents worry about the different education systems back home, which are sometimes tougher in math and science than the U.S., and the need to cultivate children’s traditional knowledge to diminish culture shock. Asha and her husband are in the midst of a debate over whether to return to India. The couple has lived separately for over a year while he
moved to Delhi and she stayed behind to continue to work in the U.S. The family is very concerned over their daughter’s education. The style of instruction is different in India, less creative, more routine and repetition and with much higher competition; they are not sure she will be able to adjust. She is in the third grade this year and they feel if they are going to make a transition like this it should be while she is still young enough to adapt. Unable to make a decision, the family is frozen in place, trying to manage a family across continents, making the best of a hard situation.

“Fitting In” in American Communities

A few of these global citizens were less interested in maintaining their traditional heritage, focusing more on taking advantage of the opportunity to learn American culture and cultivating American friendships. Shuang (F, 31, China) distances herself from other Chinese women who she describes as more traditional and conservative; she points out that they insulate themselves within the Chinese community and do not socialize much with other groups. “I have no objection to that, but for me I feel I want to be more part of the culture and have a more diverse life,” she says. “Maybe ask me again when I have a kid,” she adds, laughing. When she was in grad school, she intentionally cultivated friendships with her American classmates and picked up cultural knowledge that she might not have acquired anywhere else. Attending school in the U.S. was an advantage for her, as it can be a great introduction to American popular culture. The informal educational setting and fewer household responsibilities enable international students to connect more easily with other students in their programs and participate in American cultural activities, such as apple picking and going to movies.

Friendships with Americans and learning American culture can be more difficult for employees who migrated after completing their education, since their principle community
revolves around people they meet in the workplace and there are fewer opportunities for socializing outside work. Friendships outside of work must be something that they intentionally cultivate, usually in one-on-one settings. Chen (F, 28, China) contends that it is harder for her to forge new friendships outside the Chinese community – she doesn’t share the same background, Americans do not know much about her hometown, and she doesn’t understand the same pop references. It is difficult to sustain conversation, let alone develop a friendship, under these conditions. Mandira (F, 35, India) agrees, citing a story about the importance of sports conversation in the U.S. “I don’t know anything about American football,” she laughs, explaining that she had to do extra research to learn the rules of the game and the names of the teams in order to sustain casual conversations in the office. This lack of shared cultural background can be a significant barrier to feeling included at work, requiring the investment of additional social and psychological energy.

During the time of my fieldwork, Devayan was making greater effort to reach out to American communities. His Indian friends were very discouraged about the long delays in the immigration process and the turbulence of the political context surrounding immigration; he found it was bringing him down. The layoff at the company only further distressed and unsettled him - did he really belong here? Would it be better to go back home? Was it a mistake to come here? Deciding that he needed to focus on more positive things, he started to look for other ways to be involved in his local suburban community. He was hesitant to branch out at first, knowing that his family did not fit easily into the communities he was interested in joining. “Which group do we belong to?” he asked himself. “Will they accept us?” However, he pushed himself to join a running group, and began going out with friends he met through his son’s school. This past year, his family took up skiing and went camping along the Hudson river. As a result, his mood
significantly improved and he began to feel much more settled. He smiled more often and felt less impatient when things went wrong. He strongly feels this simple shift toward cultivating a wider circle of friendships changed his perspective and he feels he has the skills now to communicate with the local community. “You just need an icebreaker,” he tells me.

Participating in sports is one way in which migrant engineers can find common ground with their American coworkers. For some, like Devayan, running and marathons are popular activities. Others participated in intramural soccer or joined fitness clubs. My yoga class was also a location of cultural convergence; although yoga’s roots are in Vedic philosophy and Hindu sacred texts, contemporary interpretations also incorporate Buddhist philosophy, Zen meditation, and a complicated mix of Eastern and Western philosophies. As a result, my classes were places where multiple beliefs could find expression and served as a bridge across cultures for many of my students. There is a gendered dimension to sports and fitness participation as well - due to their additional responsibilities at home, women are often less able to take advantage of these forms of community. My yoga classes were a good example of this difference - while my noon classes had many female students, my morning class was almost entirely men. Women often expressed desire to come to class in the mornings, but the challenges of getting their kids ready for school in the morning meant they could never reliably commit to that schedule. As a result, women were more likely to squeeze in half-hour workouts over the lunch hour. Marathons were another area that was male-dominated. Although men found great meaning and purpose in the discipline of training for a marathon, women simply did not have time for the lengthy daily running regimen.

From my perspective as a white American researcher getting to know participants from different cultural backgrounds than my own, I would add an additional barrier to cultural
integration that is often unacknowledged: the willingness of the hegemonic (white, American) community to take action to actively include cultural outsiders. A rather unequal burden is placed upon minority engineers to include themselves, while little action is expected of those in the majority. To actively include migrant engineers, Americans must become more willing to put themselves in slightly uncomfortable situations in order to make a connection. For me, this included learning how to properly pronounce names, asking about their personal lives, inviting them for coffee, and attending events where I was the cultural outsider. This is not easy or comfortable. Navigating feelings of being out of place and fears of saying the wrong thing can be awkward. The work of making oneself understood and trying to understand can be exhausting. Furthermore, many engineers might consider these actions to be wasteful, frivolous, or unproductive uses of time. I began doing these things because I was an anthropologist and it was my job to get to know strangers, but I quickly discovered how necessary this work is to laying the groundwork for a personal friendship. Only after this foundation was established did my participants feel comfortable reaching out to me. The more I showed my willingness to learn about their lives, the greater the trust between us grew. Small gestures of friendship from the local community toward cultural outsiders are an essential first step, before inclusion can even begin. Somewhat counterintuitively to engineering and management’s cultural for efficiency, American community members must extend additional care toward those on the margins in order to facilitate their belonging.

Women Engineers in Community

In most contexts, women’s volunteer work is the foundation upon which most local communities operate. Women form the backbone of churches, community centers, neighborhood associations, book clubs, and other local activities. However, for women engineers, after the
demands of work and their households are met, most simply do not have a lot of time left over to participate in their communities. DiLeonardo (1987) found that in addition to paid labor and unpaid domestic labor, there is a third form of labor, “kin work”, that women do to maintain their extended families and local communities. This community labor tends to be left undone in scenarios in which both couples work - women do not have time and men either don’t recognize it’s missing or are happy to do without. Women engineers often feel like outsiders in their local communities, both because they have less time to volunteer and because their socialization as engineers makes them feel disconnected from other women in these communities.

In the local churches and community centers my participants frequented, a significant amount of work was done by stay-at-home wives. While not all women engineers attended community events, those who did would often prioritize attendance at services and festivals. Particularly for women with young children, many felt it was important for their children to learn native languages and cultural traditions. However, women engineers had limited amounts of time that they could volunteer, which led to a shallower experience of belonging in these communities.

In addition, much of migrants’ social lives outside of work are gender segregated, in which women are expected to socialize primarily with other wives and mothers in the community (Gabaccia 1992). This becomes complicated for women engineers, who have more in common with their male peers than their wives. “There are no PhDs, no managers, no master inventors,” Janaki (F, 42, India) laments about the other mothers at her kids’ schools. She has learned to hide the fact that she has a PhD from other mothers. People treat her differently when they find out she is an engineer, not to mention that she has a doctoral degree. One time she was discussing her career with a special education teacher and she let her secret slip. It made the
other woman feel self-conscious and shut down all further conversation. “It does damage,” she
tells me. “I’ll never belong in that set.” Instead, Janaki has forged a friendship with a woman
who is a judge and faces a common struggle of a difficult job in a male-dominated field. They
don’t see each other often, but they share a strong, often unspoken, connection. “Every time we
meet, we just look at each other and sigh,” Janaki laughs.

In addition, women’s socialization as engineers requires a kind of “hardening” that makes
them feel out of place with other women. “I had to get kind of hard,” Vidya said. “Get kind of
man-like.” The engineering work culture produces a style of no-nonsense communication and
blunt directness, which can feel overly aggressive in conversations with other women. Ruth (F, 26, White American) has given up on forging friendships with women entirely, complaining that
women do not understand her and are too “backstabby.” “I’ve never really gotten along with
girls,” she tells me. “They’re my friend one day and not my friend the next day and I don’t know
what’s changed.” She laments the gossip and frivolity that she feels pervade women’s circles of
friendship. Although this sentiment is more characteristic of American women, many migrant
women also feel more comfortable with men’s direct style of conflict resolution, which they
have come to see as simpler and more straightforward. Thus, women engineers frequently
subvert gendered styles of conflict management by eschewing passive forms, such as gossip or
backchannel aggression, and embracing direct and open conversations.

However, while some women in this industry, like Ruth, feel satisfied with having
friendships mostly with men, many women deliberately seek out friendships with other women

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3 Among engineers, women have a reputation for being passive aggressive, for gossiping behind people’s backs, and
for having unreasonable expectations in social relationships. This may be due to the fact that women are socialized
to avoid direct conflict, to please others, and to be obedient. Bourdieu argues that through gossip and passive
aggression, women are simply using the tools available to them to get what they need. Denied the ability to directly
challenge others, nor adequate training in how to wield power, women resort to backchannels, such as gossip and
political maneuvering.
and find outlets for the expression of their feminine side. They may choose to participate in sororities, knitting circles, and book clubs. Others make friends with the mothers of their children’s friends, which offer a convenient and efficient way to socialize while also attending important events for their children. These connections with women provide an outlet for venting frustrations about the male-dominated career they work in, as well as an avenue to “do femininity” (Pierce 1996; Butler 1990) in ways they may not be able to express at work. However, there is considerable pressure to keep these feminine selves separate from the “hard”, masculine selves they perform at work. Vidya mentions to me a high-ranking woman at the company who is an expert crafter but has sworn Vidya to secrecy about her hobby because she is afraid it will harm her reputation as a “bulldog” at work, an identity she very much wants to maintain. While outside of work, women are free to explore avenues for self-expression, once they enter the workplace, they must again don the “hard”, professional persona of an engineer.

**Communities for Women Engineers**

In recognition of the difficulty women engineers have had in finding community with other women, communities have emerged dedicated to the shared purpose of connecting with other like-minded women and promoting women’s advancement in the field. During my fieldwork, I attended a number of events for women engineers, including several social gatherings of the regional chapter of the Society of Women Engineers (SWE) and a prominent conference for Women in Semiconductors (WiS). Women also have access to women’s networks within their companies, which provide continuing education, social networking and social events throughout the year. These communities have been critical for creating a sense of solidarity and empowerment amongst women engineers and a structure through which women can help empower others.
In these social circles with other women engineers, women often feel they can speak more openly about work and life issues that can’t be discussed at work and would not be understood by women who did not work in engineering. At one social gathering of the regional SWE chapter, women discussed openly the discrimination they experienced at work over card games and drinks. In one group of women, they discussed salary discrepancies they discovered between themselves and their male colleagues and strategized about how to approach their managers about correcting the gaps. Another young woman was considering changing companies and needed advice about how to negotiate her starting salary. A third talked about her relationship with the tradesmen on the job site and recommendations were circulated about how women can develop a good working relationship with the trades. In this way, women are able to ask questions and find solutions for problems they are experiencing specific to their role as women engineers that they would not have found in other types of women’s groups or work-related networking events.

These women’s groups are also the source of a discourse of empowerment that women engineers use to bolster their confidence and situate their experience as a sacrifice made for the benefit of future generations of women. The women in this study expressed a high level of passion for their careers and a drive to make the field more equitable for future generations. This expression of solidarity with other women was expressed frequently, such as with Emily (F, 34, White American):

“If you’re passionate, let that be your driving and motivating factor. And the more of us there are, the more we can integrate and we can be taking those top positions and make that culture more amenable for women. So everyone together.”

These empowering messages do important work in bolstering women’s confidence and passion to persevere in the face of great obstacles. In these groups, women learn how to be women in this
field, finding encouragement and examples of how to merge engineering with femininity. As women make their way through their lives in engineering, they gain confidence to tell others, “you can be whatever you want to be.”

However, this kind of empowerment also comes with obligations and pressures to succeed in engineering on behalf of all women. Women engineers frequently view it as their responsibility to be good representatives to recruit and retain women in STEM fields. Their success is tied to the success of all women, which makes the risk of failure greater. It is therefore a difficult balance to strike to create a sense of women’s collective strength while avoiding adding to their burden. It is enough to simply survive in engineering without also feeling you are responsible for the success or failure of others.

In addition to providing a sense of collective solidarity and a horizontal network of female colleagues, women’s engineering groups can provide vertical networks for women’s success up the career ladder. While past leadership circles have been “boys clubs” – and remain so, to a large extent – women are beginning to establish and mobilize their own vertical pathways to match the ones that have previously been monopolized by men. The importance of these vertical networks has been noted by many scholars, who have pointed out that women’s social networks tend to be “flatter” than men’s, and that women tend to need a wider range of network contacts to contribute to their advancement (Ibarra 1997). The sense of solidarity that is cultivated in these groups spanning women at all levels and across all departments within a company has the power to open up new channels to women that have previously been unavailable, as women look out for other women coming up the pipeline behind them and use their own power to advocate for their promotion.
However, there are some down sides to this form of community. First of all, women’s groups in engineering tend to be something that is done on the side and is not viewed as an “essential” task for most employees. It is done when women have the time to do it, and it takes time away from other types of tasks. Women tend to stop attending once their careers are well established or after they have had children. In addition, these groups are overwhelmingly dominated by white American women. Although the Women in Semiconductors (WiS) conference was an exception to this rule, hosting several Asian women as panelists and attendees, in general, these groups must do more to attract a critical mass of women of color in order to avoid the impression that they serve only white women’s interests.

Furthermore, in many cases these groups retain the individualistic business style that is cultivated in corporate culture. They are frequently treated as sites for networking to improve individual career outcomes, or become places where conversations are guarded, carefully avoiding direct critique of managers or company policies, focusing instead on de-contextualized concepts related to “how to get ahead”. Casey (F, 27, American) remarked to me that she often feels uncomfortable speaking openly at her company’s women’s network because she is not sure who might take something the wrong way, or might relay something she said in confidence on to her boss or someone else on her team. Emily (F, 34, White American) also felt uncomfortable at these events, describing them as “transactional” and superficial, as if everyone is there to serve their individual interests, rather than to sustain real connection with other women. In these comments, I find a critique of the individualist culture of a “networking event” in contrast to the possibilities of a true “women’s collective”.

It is not clear if women engineers recognize the tensions between this form of collective action and the individualism cultivated through productivity discourses. Women feel its conflict,
that is certain. They understand the give and take of time devoted to women’s groups and mentorship as a detractor from time devoted to one’s own career. Often, they justify taking the time to participate in these groups by arguing that it will help them will advance their own careers. However, treating women’s groups as an opportunity for career advancement only further entrenches individualist modalities that actually undermines women’s ability to view themselves as part of a cohesive group. As discussed in Chp 5, as women progress up the corporate ladder, they come to see their own success as more important than women’s collective success, and the fear of their failure becomes a justification for competition amongst other women.

On the contrary, the value of these groups emerges from their historical roots in “consciousness raising” circles in 1970s feminist organizations. In these groups, women would tell the dirty secrets that could never be discussed in polite society, overcoming shame and stigma, enabling other women to see themselves in their stories, and to be liberated through their emergence into the daylight (Rosen 2000). Women’s groups in engineering could do a tremendous amount of good by focusing on the hidden criteria for promotion, the relational and political aspects that are often unrecognized in linear explanations of how to get a promotion. These discussions could serve as vehicles through which to normalize the ways in which women’s pathways diverge from men’s, so that career interruptions and lateral moves are not death knells for advancement, but simply alternative routes to the top. Frank discussions of the company’s strategic trajectory, managers who are well positioned, managers to avoid - these are frequently taboo topics because they are seen as political, loaded, judgmental, dangerous. However, these are precisely the kinds of information women are missing in their assessments of how to rise in their careers. Open discussion is needed about conflicts women are experiencing
right now, in the current moment and context, in a group that is bound to secrecy, and has committed not to shame or blame women for their failure, but rather to support and strategize how to maneuver around these obstacles. A network that is prepared to mobilize to support women who are being ignored, bullied, or pushed to the margins. There is tremendous potential to become or create an organization that is dedicated fully to the advancement of women above all other goals - including above the goals of individuals and the goals of the company. And it requires this notion of collective good, the ability for women to view themselves as members of a cohesive cohort within engineering, determined to rise together, as opposed to a loose collection of individuals, striving individually toward individual goals. It requires the re-evaluation of what is deemed “important” and “unimportant”, prioritizing the creation of a community of care. It is a subtle shift, and one that directly challenges many aspects of company culture, but the potential is liberating.

Flexible Selfhood: “We’re Not Anywhere”

Over breakfast at a swanky coffee shop that one participant remarked reminded them of European cafes, Vidya tells me about her struggle throughout her life to find a place where she belonged. “I went and joined a sorority for a sense of belonging,” she says. “But I also didn’t really fit in there with them either. I belonged more with the engineers, from a thought process and critical thinking point of view. But…I’m not your stereotypical engineer.” I asked her whether she felt she was trying to satisfy different aspects of her personality with different groups. “Yes, but I was used to that, right? As a child, as a first-generation Indian-American, I never knew where I belonged period…What are we? We’re not anywhere! Not feeling belonging didn’t feel unusual. It was normal. This must be normal. This must be a normal feeling.”
This experience of fragmentation as a normal condition of life was echoed by many other engineers in this industry. Women felt as if they didn’t belong in the masculine culture of engineering. Immigrants felt out of place in American culture, both at work and in their communities. As a result, transnational semiconductor workers distributed themselves amongst multiple communities, constructing a partial sense belonging in each. Each community contains its own set of membership criteria, which are imperfectly interpreted and imperfectly enacted by its members. Individuals do their best to maneuver around the perceived boundaries and obligations of group membership. A sense of fulfillment is often experienced, but it is always accompanied by a lingering feeling of being an outsider along one criteria or another.

Janaki actively cultivates a multiplicity of interests in order to find points of connection with the people around her. She joined a group that does crochet and makes earrings. She plays up her love of tinkering when hanging out with engineers. It was hard to get to know her neighbors at first, but eventually she discovered they loved Indian food, so she started inviting them over for dinner. “You have to keep changing the lenses,” she tells me. Every person might have something that she could find a common interest with. At the same time, there were so many factors by which she might be excluded. “I’m Indian, I’m a woman, I’m an introvert, I like physics…just one little thing and I’m out of the group!”

Many engineers, especially early-career engineers, express resentment and dissatisfaction with the additional work that is required to negotiate belonging. “I am an outsider here,” Lifen (F, 29, China) told me over lunch one day. “It’s not my world. My world is China.” When Lifen looks around her, she sees inequalities. Inequalities between men and women. Inequalities between Chinese and Indian and American workers. Inequalities in the treatment of low-level employees and high-level employees. It rankles her. She considers transferring to a different
department or a different company, hoping conditions might improve. For the moment, she is in a holding pattern, waiting for conditions to change, waiting for some tiny shift that would return her hope and optimism that success and balance are possible.

For other employees, their dissatisfaction is rooted in national and transnational structures. Ravi is deeply discouraged with the U.S. immigration system, which is particularly cruel and burdensome for Indian immigrants. He is disappointed with the trajectory of his career, which has required him to be dependent upon his company for their visa sponsorship. He is not sure what his next career step should be and he feels paralyzed, knowing there is very little he can do to change his situation. Shuang points out that her sense of belonging is also dependent upon her visa status. She cannot count on renewal, and therefore, can only plan three to five years into the future. This is difficult especially for someone at her stage of life, trying to determine whether and when to have children. Should she stay here and raise them in the U.S.? Or return to China, where there is a lot of opportunity and less discrimination?

There appears to be a learning curve associated with this persistent feeling of non-belonging. Vidya describes her trajectory from childhood to the present as a transition toward acceptance.

“I did have that resentment, like, why do I have to work doubly hard at everything? Why do I have to convince this crowd about this part of me and that crowd about that part of me? It’s frustrating right?...But the tradeoff there is, not fitting into a particular area, makes you unique. And it really gives you a tremendous amount of perspective. And respect for all different cultures and respect for other thoughts and diversity.”

Janaki agrees, saying she has shifted her perspective from telling herself, “I’m the outsider” to “No! I’m the one who is going to bring the most value because I think differently!” This wisdom seems to have been developed over years of working in the industry and it was most common amongst the women in this study who have made it to management levels. Extraordinary
flexibility is contained within this transformation. In the midst of holding together the strands of belonging for their families, women forge flexible, hybridized identities for themselves. They navigate double-binds of gender and ethnic identities and communicate across cultures, learning to simultaneously fulfill their need for belonging partially across multiple communities. They have learned to live in the marginal spaces, transforming their difference into advantage, positioning themselves no longer as outsiders, but insiders with unique perspectives.

Conclusion

The need for belonging is overlooked and underappreciated, particularly in engineering and management cultures that are driven by efficiency. The kind of care required to sustain community is inefficient. Most of the time, it would not be considered productive. And yet, even without a language to describe it, engineers notice the presence, and lack, of belonging. Carmen (F, 37, Puerto Rico) reflects:

“The places where I’ve been the happiest in my career have been times when I feel like the people around me are my friends. I feel like I haven’t had that in a long time. It’s a lot easier to deal with some of the pressures of the job and a lot easier to deal with the big stressors when you have people who have your back. It’s a lot harder when you don’t have anybody to rely on, or anybody to fall back on. The times when I’ve been most successful and happiest in my career have been times when I feel like my coworkers are my family. And it’s very hard to find places and roles that feel like that.”

Sustaining the level of cultural diversity found in these communities requires additional time and attention to care. With so much of their lives unsettled, this new “global precariat” (Berlant 2011) must invest tremendous effort to create stability in the places that have been uprooted. In the absence of a stable foundation, they accomplish this through flexible selfhood, stretching themselves across multiple communities, patching together relational identities, in a life that feels increasingly fragmented.
In their lives on the integrated circuit, women and migrant engineers craft webs of belonging distinct from established modes of family, culture and nation. Each web is different, pulling strands from different communities according to individual preferences. Engineers living abroad mitigate losses of traditional modes of belonging by using technology and travel to reinforce family bonds overseas and reimagine their sense of cultural belonging as part of a diaspora. They also recreate new forms of communities as they relocate around the world. Whether taking part in “third spaces” like religious or ethnic communities or forging new friendships in American circles through marathons or yoga, each individual constructs a careful nest, allowing their families to rest in the structures of safety. Although women engineers feel especially out of place in the diaspora, they are able to forge new connections with other professional mothers or in women’s engineering groups. These new webs are imperfect, constantly changing, and exact new kinds of reciprocal obligations. And yet, they accomplish a sense of fragile stability while striving for purpose and meaning on the “bleeding edge” of technical, and human, progress.
CONCLUSION
Finding Stability in a Volatile World

My understanding of what belonging means in semiconductors began to shift following my conversations with engineers after the layoff. So many engineers - men and women alike - experienced the layoff as a trauma, upending their sense of safety and their understanding of how they fit into the world. For workers who found themselves adrift on the “integrated circuit”, it became clear that not only were they working on the “bleeding edge” of technology, but also on the “bleeding edge” of human flexibilization. Like the microscopic chips defying the laws of physics, the boundaries of their lives blurred and would not remain fixed, challenging their ability to find stability and function normally. The intensive flexibilization has demanded a reorganization of human connection and community - a task that has largely become the domain and collective obligation of women.

The stakes were made clearest by Lucas (M, 35, France) and Anna (F, 32, Bulgaria), a European couple who found themselves both suddenly out of a job. They both felt they had sacrificed their sense of belonging in Europe in order to be a part of the exciting world of semiconductors. They had reconstructed their sense of belonging to revolve entirely around being a part of this global community, only to find themselves sharply evicted from it. Lucas clarifies,

“This was one reason why we are so broken from being laid off. Because we feel that we belong to the semiconductor industry. We feel that the work we are doing is important, is doing something for society and this makes us feel better...It's like a family for us. You go to work and you feel safe there, and you feel accomplished there. And you meet all these other people that do the same things for the same goal like you. And you feel like you belong to this society, but now we are laid off and now we question, do we really belong there?”
For engineers in this industry, this is the price of entry in semiconductors. Engineers leave behind the communities and connections they have found in their places of origin, in order to gain belonging with others who share their excitement of a global career in a new area of technological development. Their sense of community is strongly bound up with their identities as engineers on the “bleeding edge”. Lucas articulates that not only do engineers in this discipline need to be technologically trained, but they must also “push the limits” of cultural openness and flexibility.

“We need to know things in extreme details. And we need to interact with huge amount of different countries, people coming from different origins. So that requires from most engineers and even managers a huge part of themselves that you pour inside this work…Engineers are always on the front line. We’re pushing the limits on so many different parts, that the human aspect is indeed stretched out. So indeed the sense of belonging, is one of the first that has to go away.”

Belonging, in the traditional sense, of family and culture and national identity, is one of the first things that is sacrificed as engineers pledge themselves to this discipline, to this line of work. They “push the limits” of human capacity by forging new ways of belonging that are centered within their companies, in their industry. They make it work. They make new ways of meaning. They find joy and fulfillment amongst the families they build, amongst the friendships and communities they create. And yet, in these moments of crisis, they find that the foundation is not stable. The company does not take into account the threats to their sense of community, which is a vital part of their existence on the integrated circuit. Their need for stability and connection is not valued. While engineers stalwartly hold up their obligations that come with belonging to their companies, they find that these obligations are not reciprocated, contributing to disillusionment and feelings of becoming unmoored from the community.

Gammeltoft’s (2014) theory of belonging brings greater nuance to previous static notions of membership, pointing out that rather than being simply “in” or “out”, or existing statically at any
given level of hierarchy, membership in a community is constantly in flux. Once membership is earned, it is not stable, but may lapse and return, requiring continued dedication and cultivation. Communities are built upon expected reciprocal relationships between members, conditions of belonging to, which carry obligations and conditions of care. In any community, there is always the implicit risk of expulsion and the requirement of self-sacrifice. In this sense, membership in the engineering workplace is expected to carry similar obligations and contingencies as members police their own boundaries. However, scholars have been sounding a warning for decades on the volatility of labor markets and the limits of human capacity to adapt (Harvey 2006; Ong 1999; Martin 1994). The neoliberal flexibilization of labor has eroded social stability in many forms including social safety nets, local communities, and families (Chamberlain 2018). The demand for increasing flexibilization has created a self-perpetuating cycle of individualistic striving, which serves to undermine the collective experiences that generate meaning for so many communities, contributing to a condition of “cruel optimism” - a hope for an ultimate freedom that rarely materializes (Berlant 2011). We are left to wonder whether it is advantageous, or even possible, to build a community on top of such a volatile foundation.

The company’s lack of acknowledgement of the reciprocal nature of belonging contributed to feelings of betrayal by many employees. Both those who were laid off and those who remained mourned the abrupt loss of friends they had made and communities they had forged while working on the integrated circuit. Scrambling to salvage the friendships that had unceremoniously been severed, the engineers who remained at the company made lists of everyone they knew who had been let go. They reached out via email or phone number if they had contact info. They communicated through listservs that sprung up to help those out of work find new positions. They arranged lunches and dinners to say goodbye. The fabric of their
communities had without warning been rent into pieces. They did what they could to patch their communities back together, while knowing that their friends would soon be moving miles away, out of their lives, perhaps forever. Many expressed to me a deep-seated anger and sadness that they found difficult to explain or justify. They knew that layoffs happened. They rationalized that this was probably to be expected in their industry. But at the same time, they felt heartbroken that the leadership at the company had not understood, or cared, about the impact that this decision would have on their employees’ sense of well-being. Leaders either did not consider, or did not value highly enough, the personal cost.

Structural inequalities simultaneously became highly visible, in particular those related to visa status and gender. Migrant workers who had not been able to attain permanent residency, or “green cards”, had only a few months to find another employer before their visas expired. The scramble to find a new job was especially chaotic and anxiety-ridden for these families, who faced the possibility that they may have to involuntarily relocate. The other semiconductor companies in the region quickly absorbed as many employees as they could, but none were prepared to find work for the over 200 employees who had been laid off. While Americans and permanent residents were able to wait it out until the market rebounded, migrant workers on temporary work visas faced the necessity of finding work immediately. This meant being willing to move across the United States, back to their home countries, or anywhere else in the world that would hire them. It was a complicated calculus of where they were likely to find jobs, versus where they were willing to go. The sudden loss of stability left many migrant engineers with an intense and uncomfortable recognition of how dependent they were on their employers.

Women faced additional constraints as they tried to keep their families together. One woman could not relocate because her husband had a stable job in the area. Another had a child in high
school who wanted to graduate with his classmates. For Anna and Lucas, it was Lucas who found a job first, but Anna had little luck. She became a temporary “trailing spouse”, hoping a West Coast company would eventually hire her. Another woman weighed the costs and benefits of moving back to her hometown of Delhi. Although she felt she could probably find a job, she feared the rampant sexual harassment in the workplace and lack of promotion opportunities for women. Even those who had been born in the Northeast felt the pull of the global labor market - a young woman who had been born in Long Island had long resisted leaving the area. Although she had not yet married or had children, she felt she couldn’t move because her parents were in poor health. As women grappled with these decisions, two things became apparent: first, that women have greater restrictions on their mobility due to their obligations to their families and concerns about their future career growth; and second, that labor mobility must be recognized as an action undertaken not by individuals, but by families, and labor and migration policy should be written to accommodate relocation at the family level.

A few engineers expressed dismay at the potential ripple effect the company’s decision might have on the regional economy. With one major semiconductor company in the area scaling back, would others follow suit? Would the local university that produced specialized graduate-level engineers for the industry have anywhere to send students? Many imagined the region being hollowed out, failing to live up to its promise to become a high tech corridor and major economic hub. In choosing to abandon “bleeding edge” technology, David (M, 39, White American) worried that the company was “abandoning the future”. He feared that the site would return to lower-risk, more reliable, but less exciting technologies. Although the company maintained that there was plenty of engineering work at the 14nm level, some engineers feared that this signaled a threat to engineering jobs. Rumors circulated of other sites that had scaled back on engineering
labor, leaving the manufacturing processes to be run by a skeleton crew of technicians, robotics, and only a limited number of engineers.

The layoff also undermined core ideologies of meritocracy and fairness. While many semiconductor engineers are familiar with layoffs, they were previously at a much smaller scale and targeted those who had poor performance. One engineer described layoffs in this industry as “like breathing” - inhaling high potential engineers, exhaling those who didn’t work out. The massive scale of this layoff meant that this time bright and hardworking people had been let go as well. The idea that you could work hard and be good at your job and still find yourself laid off shocked and unsettled many engineers. Everyone had an example of a “good engineer” who had been dismissed. For David, the embodiment of this phenomenon was Priya. “She was one of the brightest people I’ve ever worked with. I can’t imagine why they wouldn’t have tried to keep her somehow.” For Devayan (M, 46, Malaysia), it was his boss, a person he deeply respected. For Michelle (F, 44, Indonesia), it was a coworker who had been so outstanding that within one day of being laid off, he had already lined up another offer. It was deeply unsettling for many to reflect on their own precarity. They had assured themselves that they were smart and good at their jobs, and as such were protected. Now, they grappled with the reality that they, too, could have found themselves out of a job.

Over the length of my fieldwork, engineers continued to reflect upon the layoff and the uncertainties they felt about their belonging in the aftermath. Over time, I observed as the company slowly returned to a sense of normalcy. Those who were out of work slowly found new positions - in Mumbai, in Seattle, in New Mexico. The company eventually rehired many of those who had been laid off to work in positions that supported the new corporate vision. Engineers gradually came to terms with the new strategic plan; many eventually even
acknowledged the layoff as a valid, if somewhat callous, action that was necessary for the continued health of the company. After a few months of holding their breath, there were no further layoffs; the rumors of buyouts died down and employees began to relax back into their routines. They began to allow themselves to feel settled. And yet, for many, a fundamental shift had occurred, like a lightning strike that had briefly illuminated the precarity of their worlds. They reassessed what was important in their lives, reprioritizing family and community. They brushed up their social networks and reconnected with old colleagues in case they needed references or job leads. Ultimately, they learned an important lesson about reciprocal obligation, or the lack thereof, between themselves and their employers. No longer would they rely on benevolence of a company, but would strive to look out for their own goals. The community has healed, but something has been lost as well. A sense of trust. A sense of community. Yet in this loss, there is also a recognition of their need for community, of the need for belonging, of the need for meaning beyond work. Perhaps something has been gained as well, as that which was invisible and taken for granted is now recognized and appreciated.

**Hope for An Alternative Future**

Throughout this dissertation, I have endeavored to construct a holistic account of the lives of engineers, and particularly the lives of women, working in semiconductor manufacturing. Hailing from every continent, engineers begin their journeys on unequal footings, depending upon the advantages and disadvantages of their location in the global economy. Although the engineering market “pulls” men, women have been able to gain access by shaking off the patrifocal expectations of education, work and family. Once firmly rooted in the “integrated circuit”, engineers are rotated to locations around the world, demanding geographic flexibility while maintaining expectations for women to manage conditions of normalcy and stability in
their families. In order to meet these expectations, women have fully embraced everyday flexibility through productivity discourses, which despite their diminishing returns, are currently their only means of meeting their obligations to their families and their workplaces simultaneously. Within the multicultural workplace, women negotiate identities as engineers that are both gendered and culturally varied, requiring the reconciliation of multiple intersecting, and often conflicting, identities. If engineers choose to pursue a management track, the demands for individual flexibility intensify with higher workloads and greater adaptation to the political and strategic goals of the company. Women, in particular, feel torn between a sense of obligation to succeed on behalf of future women engineers and the obligations they have to their families. Women on the promotion track also struggle with the “in/visibility paradox” and the additional career breaks and lateral moves embedded in their pathways. Meanwhile, in their lives outside of work, engineers create meaning through hobbies, friendships and communities that produce a sense of purpose and connection in contexts where they have become distanced from their extended families and local cultures. Much of the work of maintaining these communities is performed by women, who hold the fabric of belonging together for their families and communities. I have argued throughout that the intensity of flexibilization has strained community relationships, circumstances that have been especially burdensome for women, and critiqued the processes through which individuals are encouraged to pursue self-interest and ignore or downplay their needs for collective belonging.

However, lest I leave my readers with the impression that we are on an inevitable slide into increasing flexibilization, into lives in which the qualities that make our lives meaningful are slowly and inexorably extracted; lest I paint a picture of a future in which the professional class scrambles, through continuous learning and self-discipline, to stay on the creative end of labor,
the kind that can’t be performed by machines, the kind that can’t be standardized, outsourced or automated, I would like to offer some hope of an alternative future. Humans have exhibited extraordinary cultural malleability, across the world and throughout history. Although neoliberal capitalism is currently the dominant force in the world, its continued advancement is not inevitable. We have tremendous capacity to reorganize and reinterpret the structures that surround us. Every disruption is an opportunity for radical change and in the midst of these disruptions, we have the opportunity to reorient our lives to value the things that truly make our lives meaningful.

Such re-imaginings require collective power - large masses of people choosing to consciously think differently about our relationship with paid work. Together, we can begin to think critically about the power that paid work commands in shaping our behavior and life choices, and determine how much flexibility, and what kinds, we are willing to tolerate in our lives. Although engineers have historically been skeptical of unionization and other forms of collective action, preferring to work with management to negotiate better benefits for highly-skilled professionals, I suggest that such efforts will have only limited impact. Chamberlain (2018) notes that even “employee-friendly” flexibility policies that enable more time for family life, such as working from home, are likely only permitted because they do not detract from, and may be proven to increase, employee productivity and corporate profitability. It is probable that in order for engineers to slow or even stop the trend of increasing flexibilization, they will need to exercise their own collective power by refusing to comply with extractive labor practices. Some scholars have argued that by exercising power in this way, through unions or professional organizations, engineers would increase the prestige of the discipline by enabling them to control the conditions of their own labor and re-dedicate the profession toward the improvement of
society, as opposed to the needs of capital (Layton 1971). Similar to professions such as law and medicine, engineers could choose to retain the right of refusal to work under conditions they deem unethical or unacceptable. This would elevate engineers’ status in companies to operate more like expert consultants, rather than highly-valued employees.

Furthermore, engineers’ meticulous calculations of efficiency need not be so depersonalized, and in fact, may become more accurate by attending to social factors. Engineers, by recognizing and assessing the value of relational experiences, could learn to factor in the importance of belonging and inclusion as a critical part of workplace efficiency. Goldman has argued that engineers, as “applied” scientists, are actually uniquely suited to becoming more attuned to relationalism. In contrast with “pure” sciences of physics and chemistry, in which conditions can be carefully controlled and repeated without error, engineering projects are enormously dependent upon the contexts and conditions of the surrounding natural and social environment. Engineering design, Goldman (2004) writes, “is a contextual and a historical process as well as being intensely particular...[it] reflects what Herbert Simon called ‘bounded rationality’ and ‘satisficing’ - consciously operating under conditions of partial information and acting on solutions judged good enough to do the job that needs to be done...” (2004:167). Although past generations of engineers have limited their expertise to simply being “technical problem solvers”, emerging conversations within the discipline demonstrate a recognition that the work of engineering requires careful consideration of sociopolitical contexts, and a desire for engineers to become more skilled at understanding these factors. A principle challenge for engineers will be in the recognition of emotional and social factors, previously dismissed as unimportant and

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1 Goldman has argued that rather than perceiving engineering as a derivative which merely “applies” pure sciences, we could reimagine this relationship, positioning pure sciences as acting in service of engineering, which does critical work in the advancement of society.
invisible, as legitimate factors that are crucial for optimal performance, or as Goldman puts it, “adding relationships to the list of the ultimately real” (Goldman 2004:174).

It is in moments of disruption that the structures of our world become most visible, and the greatest, most profound changes become possible. The COVID-19 pandemic may prove to be an important historical moment that re-arranges the way we think about work, and by extension, about flexibility. The pandemic forced companies to reimagine work in a world in which the majority of employees must work from home. This has given employees the opportunity to demonstrate their effectiveness and productivity, while also making highly visible the challenges of balancing work and childcare. While there is much work to do to make work equitable for women, there are many positive developments that are emerging during this moment. As a result of the recognition that the vast majority of work can be done from home, there is now an opportunity to push for greater “employee-oriented” flexibility. Such efforts should focus on the types of flexibility that have a positive impact on employee security and stability, and offers greater resistance to market turmoil. The revelation that men also benefit from flexible work arrangements may also do significant work in undermining the gendered symbolism the equates flexibility with women’s work, and the removal of obstacles and excuses for why everyone should not be able to work from home if they choose.

Times of great upheaval remind us of the importance of belonging, stability and relationships with others. The pandemic has highlighted the importance of social relationships, leading many to recognize the value of things previously taken for granted in the workplace – conversations around the water cooler, chatting before meetings, lunch with colleagues, etc. The visibility of the absence of collective belonging during the pandemic should give us greater ability to name the things that we have missed and find solutions for intentionally integrating them into the
workplace in the future. Perhaps the moment has come to reorganize work in a way that works for women. A way that accommodates family life rather than distributes it to others. A way that enables connection and community as a fundamental need for a happy and fulfilled workforce. A way that is more equitable in its distribution and valuation of labor around the world, wherein workers who want to migrate can, but wherein migration is not necessary for economic security or social mobility. We simply cannot imagine the challenges of the future. Natural disasters due to climate change, which at the time of this publication in 2021 seem as unreal and unlikely as a pandemic did in 2018, may ultimately force humans as a global community to address the unsustainable practices that have led to their creation. We cannot imagine the cultural adaptations we will invent for our own survival, the conditions we will collectively decide are manageable. Engineering industries, by and large, figured out how to allow the vast majority of their workforce to work from home for an entire year. What else might become possible when forced to confront the challenges of the future? My hope is that we will choose to use these disruptions to prioritize stability and re-center human wellbeing as fundamental to our thriving.
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Mill, John Stuart  

Miller, Claire Cain

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Mohanty, Chandra Talpade

Morgan, Lynn M.

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Morrill, Calvin

Mozingo, Louise

Nader, Laura

Nakamura, Lisa

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Nash, June

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Nicholls, Heidi J.

Noble, David F.

Noland, Marcus, Tyler Moran, and Barbara R. Kotschwar

NSB, (National Science Board)

NSF, (National Science Foundation)


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Oldenziel, Ruth

Ong, Aihwa

Ong, Maria, Carol Wright, Lorelle L. Espinosa, and Gary Orfield

Orellana, Marjorie Faulstich, Barrie Thorne, Anna Chee, and Wan Shun Eva Lam

Ortner, Sherry

Ortner, Tuulia M., and Monika Sieverding

Ospina, Sonia
Parikh, P. P., and S. P. Sukhatme

Parker, Kim

Parrenas, Rhacel Salazar

Pedulla, David S., and Sarah Thébaud

People Keys

Petriglieri, Jennifer Louise, and Otilia Obodaru

Pham, Becky, and Sun Sun Lim

Pierce, Jennifer L.

Plafker, Ted

Plaza, Dwaine
Post, Corinne, Nancy DiTomaso, George Farris, and Rene Cordero  

Preston, Kate, and Arthur Grimes  

Pringle, Rosemary  

Qiu, Jack Linchuan, Melissa Gregg, and Kate Crawford  

Radhakrishnan, Smitha  

Reid, Erin  

Reinert, Maddy, Theresa Nguyen, and Danielle Fritze  

Riley, Donna  

Roberson Hayes, Amy, and Rebecca S. Bigler  

Romero, Mary  
Rosaldo, Michelle Zimbalist, and Louise Lamphere, eds.

Rosen, Ruth

Rossiter, Margaret W.

Rubin, Gayle

Rulison, Larry

Said, Edward W.

Schewel, Kerilyn

Scott, James C.

Seager, Joni

Seron, Carroll, Susan Silbey, Erin Cech, and Brian Rubineau

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Shan, Hongxia
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Sloterdijk, Peter  

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Smith Rolston, Jessica

Smith, Vicki

Stevens, Matt

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SWE, (Society of Women Engineers)

Tang, Joyce

Tannen, Deborah

Taylor, Charles

Tharenou, Phyllis

Thorkelson, Eli

Tinn, Honghong

Tonso, Karen L.

Torres, Lisette E.

Treas, Judith, and Shampa Mazumdar

Trines, Stefan

Tuana, Nancy

Tzannatos, Zafiris


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USDOL, (US Department of Labor)

Varma, Roli

Vertovec, Steven

Wajcman, J.

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Weber, Max

Weeks, Kathi

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