The Fuzzy and the Techie

WHY THE LIBERAL ARTS WILL RULE THE DIGITAL WORLD

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The Role of the Fuzzy in a Techie World

One time she was Kate in *The Taming of the Shrew.* Another time she was Adelaide in *Guys and Dolls.* But on her own stage, Katelyn Gleason is the founder and CEO of Eligible, an innovative health-care technology company. A theater arts major at Long Island's Stony Brook University, she never anticipated that she would become an entrepreneur, let alone a tech entrepreneur. But after founding her own company when she was twenty-six years old, and raising $25 million in venture capital from some of the most successful entrepreneurs in American business, she credits her acting experience with contributing significantly to her social skills, confidence, and talent for sales, which were all instrumental in launching Eligible.

Katelyn became a health-tech entrepreneur by chance. She could have been a poster child for the argument against a liberal arts education made so often in recent years: that it doesn't prepare students for the jobs the economy needs filled. Indeed, once she determined that acting might not work out and that she should search for other work, she had no clear idea what kind of job to

look for. She did know that she was very good at sales. During college she had supported herself by working as a sales director for a company that published a business directory.

Katelyn says that her acting experience helped with that work by teaching her how to be persuasive in her sales pitches, and also how to deal with the emotional impact of people telling her no again and again. Acting taught her how to quiet her self-doubt and forge ahead despite rejections. She proved so talented at selling that by the time she was twenty, she was managing a sales force of forty. As she looked for job openings in a wide-ranging job search, she was drawn to an advertisement on Craigslist for a job in sales for a web-based startup providing services for health care practices, called DrChrono. The company provided scheduling, billing, and order management for clinical tests and prescriptions. Despite knowing nothing about the health care industry, she knew sales, and she felt confident she could learn what she needed to know to get the job done.

DrChrono hired her as a contract salesperson, and Katelyn began learning about health care and about building a business. She discovered that she was fascinated by the process of innovating a business and loved being part of a small entrepreneurial team. The founders also loved having her. Her sales ability was so impressive that the founders asked her to join them in pitching the company at the highly competitive contest for startups held annually by Y Combinator (YC), a Silicon Valley startup incubator. Winning startups are admitted to a rigorous three-month program, during which time YC founder Paul Graham and a team of successful entrepreneurs and investors offer guidance about how to develop their businesses. DrChrono won a coveted spot, and Katelyn impressed Paul Graham so much that when she decided

to leave DrChrono, he advised her that she should found her own health-tech startup, even though she didn't have fancy degrees from an Ivy League school or stellar connections like some of her peers.

Katelyn still knew relatively little about technology, but she did have a clear idea for a business. She had been stunned by the inefficiencies in the way doctors' offices verified patient insurance coverage. It was done mostly by phone and involved time-consuming paperwork, which often led to long delays and to mistakes. Quite often, doctors ended up swallowing the costs of procedures because patients didn't actually have the coverage the doctor thought they did. Other times, patients ended up with crushing unexpected bills. She recalled, "I'd dealt with the front office, and the billing systems. There was one company everyone used called Emdeon." But the technology the Emdeon system was built with was old, and for doctor's offices, connecting their own data systems to the Emdeon system was expensive and time-consuming work. Katelyn had heard about another YC-backed startup called Stripe that offered an easy way for one hundred thousand merchants, from Best Buy to Saks Fifth Avenue to Adidas, to handle all the complexities of accepting payments on the Internet. She boldly decided that she would create a similar system for health care providers, a system faster and easier than Emdeon. Though she had no idea what programming would be involved, she believed she could learn what she needed to know in order to hire software engineers to do that work.

Hunkering down in her apartment in Mountain View, California, in the heart of Silicon Valley, Katelyn threw herself into reading about the technology the system would require. She audited free online programming classes offered by various universities,

and spent her days in the public library devouring books. She forced herself to read Apple's software developer kit from start to finish, and asked questions she had on the developer collaboration website Stack Overflow. With that basic knowledge under her belt, she hired two freelance software engineers, and as they built a prototype, she began seeking angel investment. "As a woman with no technical background," she recalled, "I met lots of skepticism, but again, my acting experience developed my resilience to keep forging ahead in the face of so many turndowns." Her acting work also helped her understand how to craft a compelling story about the company, which is essential to convincing investors to provide support. "In theater, the playwright gives you the play, but you have to tell the story," she explained to me in 2016. "I knew I just had to figure out how to tell the right story. When you start rehearsal, you're completely lost. You don't know the characters at all. When you start to build a product, when you start to build a company and you don't even know what your product is going to be, it's exactly the same feeling. You're completely lost. I learned in the rehearsal process that if I worked hard enough, I could gain that internal clarity where I would start to take off like a rocket ship."

In the summer of 2012, Katelyn found herself back at Y Combinator, pitching Paul Graham and team, but this time as a startup founder. She won their backing, and on the heels of their support, she was able to quickly raise $1.6 million to continue building Eligible's product. After launch, the company took off, with a growth rate of 60 percent week over week. In 2013, Katelyn was selected by *Fast Company* magazine as one of its top one hundred most creative people, and in 2015, she was named one of *Forbes*'s 30 Under 30 innovators in health care.

Being CEO of a company is just the latest way Katelyn is under

the spotlight, on center stage. She is a fuzzy who joined with techies to solve a problem long overdue for fixing, and she relishes knowing that her company helps process over ten million health insurance eligibility claims per month, bringing efficiency and savings to an industry ripe for improvement.

Katelyn could never have anticipated how her undergraduate experience would prove so valuable in teaching her to dig in and learn what she needed to know about the technology to build her company, or how transferable the skills she had learned about being a confident, highly persuasive communicator would be to entrepreneurship. Rather than be a poster child for the impracticality of getting a liberal arts degree, she became a representative of how applicable the fuzzy skills developed by the liberal arts are, as well as how important they are as complements to technological expertise. Many other successful founders of innovative technology-driven businesses also credit their liberal arts education with preparing them for pioneering new ways of harnessing the power of technology. Founder of corporate communications platform Slack, Stewart Butterfield credits his ability to develop a successful product to following lines of inquiry to their logical conclusion. It's fitting that Butterfield studied philosophy at both the University of Victoria and the University of Cambridge, but his story is not unique. LinkedIn founder Reid Hoffman earned his master's degree in philosophy at Oxford University. Billionaire venture capitalist and cofounder of PayPal Peter Thiel studied philosophy and law, and his cofounder of Palantir, CEO Alex Karp, earned a law degree and then a PhD in neoclassical social theory.

Ben Silbermann, the billionaire founder of Pinterest, studied political science at Yale, while Airbnb founders Joe Gebbia and Brian Chesky earned bachelor of fine arts degrees at the Rhode Island School of Design. Steve Loughlin, founder of RelateIQ, which

Salesforce bought for $390 million three years after he founded the company, was a public policy major. The cofounder of Salesforce, Parker Harris, studied English literature at Middlebury College. Former Hewlett-Packard CEO Carly Fiorina was a medieval history and philosophy major, and YouTube CEO Susan Wojcicki studied history and literature at Harvard. Take a look around Silicon Valley, and many of these exemplars of "tech" are grounded in educations that taught methods of interrogation and rigorous thought, with many technology companies formed on the philosophies learned through liberal arts educations. The United States has no exclusive on this; across the Pacific, the richest man in Asia is Jack Ma, the founder of the e-commerce giant Alibaba. He was an English major. While a bounty of opportunity undoubtedly exists for techies as well, and they are in high demand, what's little understood about today's tech-driven economy is that as technology offers an ever more accessible toolbox, our differentiation—our very competitive advantage—becomes the very thing liberal arts programs teach.

The Origin of the Terms

I first heard the terms "fuzzy" and "techie" as an undergraduate at Stanford University. If you majored in the humanities or social sciences, you were a fuzzy, and if you majored in engineering or computer science, you were a techie. This lighthearted moniker—calling liberal arts specialists fuzzies in contrast to Stanford's heritage as a leading center of technological innovation—has never deterred students from filling their schedules with liberal arts classes, primarily because the university promotes a well-rounded education, and professors firmly believe that success comes from exposure to a broad range of disciplines.

I chose to be a fuzzy, majoring in political science. I took some

fascinating classes that introduced me to recent developments in technology, such as Technology in National Security, and the Entrepreneurial Thought Leadership seminar, for which top technology founders and investors come to lecture. But I nurtured my intellectual curiosity, studying ancient history, political theory, and Russian literature rather than seeking vocational preparation. During college, for two years I worked at the Center for Biomedical Ethics on cutting-edge applied philosophy. From there, I went to work in the domain of technology at Google, Facebook, and Harvard's Berkman Center for Internet and Society. Ultimately I became a venture capitalist, where my job has been to meet with and evaluate tech startups, working with them to help them launch and grow successfully. My education at Stanford taught me that I wouldn't be graduating with a second-class set of skills to those learned by the techies across campus, but rather a complementary set of skills, equally necessary in today's technology-driven economy. My graduation speaker was Steve Jobs, who famously told us in his speech to "Stay hungry. Stay foolish." Jobs also once said how important the humanities and social sciences are to creating great products, and that "technology alone is not enough—it's technology married with liberal arts, married with the humanities, that yields us the result that make our heart sing."

A great deal of media coverage and a number of recent books warn about the threat to jobs from a surging wave of technological innovation that is leading to such breakthroughs in automation as self-driving cars and robot home assistants. We are in the early days of what Massachusetts Institute of Technology (MIT) economists Erik Brynjolfsson and Andrew McAfee dubbed the "Second Machine Age" in their influential 2014 book of the same title. This line of argument suggests that the skills that will secure people gainful employment in this emerging era are those learned by an

education in the STEM fields—science, technology, engineering, and math. Earning a liberal arts degree is characterized as an impractical extravagance the workers of the future simply can't afford.

Reading novels and poems, revisiting the debates of ancient philosophy, or studying the history of the French Revolution or the culture of a remote island community isn't likely to get you a decent job in today's more tech-driven economy, and certainly not in the future, or so the argument goes. Microsoft founder Bill Gates caused a stir in a speech to the National Governors Association that state funding in support of liberal arts education should be cut and more money dedicated to higher education in the STEM fields because those are the skills that will get people well-paying jobs. Billionaire cofounder of Sun Microsystems Vinod Khosla, now a leading venture capitalist investing in technology startups, has gone so far as to say that "little of the material taught in liberal arts programs today is relevant to the future." Silicon Valley venture capitalist and software pioneer who created the search engine Netscape Marc Andreessen quipped that those who learn the "soft skills" of the liberal arts in college, rather than the "hard skills" of science and tech, "likely will end up working in shoe stores."

Be Concerned, Not Fearful

The alarm about the future of work, and about the prospects of liberal arts graduates, is clearly founded in genuine concern, but it is also sorely misguided for a number of reasons. First of all, as we'll explore more fully in Chapter 8, though increasingly "smart" and nimble machines will likely be taking the place of some workers, the extent of likely job displacement has been greatly exaggerated. The threat to some jobs is not only clear; it is already present. Robots will assume more and more tasks that can be fully automated, as they've already done with jobs on the assembly lines of so many manufacturers. But the proportion of jobs that can be fully automated is more limited than suggested by forecasts. In many jobs, a number of tasks that can be automated, because they are routine or can be better performed by crunching vast amounts of data, will be taken over by machines. But in many cases, the result will not be to displace human workers; rather it will be liberate people to spend more time on the aspects of their work that require uniquely human skills—nonroutine tasks and complex problem solving that machines can't perform and may never be able to do.

Look no further than the legal profession to see change in the making. In 2015, MIT labor economist Frank Levy coauthored a paper with Dana Remus of the University of North Carolina School of Law called "Can Robots Be Lawyers? Computers, Lawyers, and the Practice of Law." The paper examined the notion that the legal profession is susceptible to automation, and that lawyers will soon be replaced by computers. Their argument was inspired by the advent of software designed to read and analyze legal documents during the discovery process.

After an extensive analysis of the time spent on individual tasks performed by attorneys, Levy and Remus found that they spend the majority of their time analyzing documents, counseling clients, and appearing in court, and many of the skills that make a legal professional especially effective, such as being able to think on their feet and interacting with clients, are, and will remain, uniquely human. They estimate that around 13 percent of legal work could one day be automated—a measurable amount, but relatively modest, especially since the change will happen over the course of many years. Instead of replacing lawyers, automation

software will make lawyers more efficient. Machines will handle routine tasks; lawyers will do the rest.

A great irony of the discussion of job displacement is that among the jobs vulnerable to dislocation and automation are many in computer programming—currently hailed as both higher paying and in the highest demand. How might this happen? First, many of these jobs will be transferred overseas to developing economies invested in training masses of highly qualified programmers—places like India, China, and Nigeria. These programmers are no longer simply an inexpensive workforce hired just to do the relatively simple work of building websites; they are being trained to great proficiency. Andela, a startup that aims to train one hundred thousand African programmers over the next decade, has so many applicants that its acceptance rate is under 1 percent. Andela invests as much as $10,000 to train each fellow in the latest software development, fellows such as Olajumoke Oladimeji, a young woman who already had a degree in computer science and electrical engineering from Lagos State University. The fellows are then matched with global companies. Due to the high pay programmers can demand, sending a good deal of programming work overseas is as unavoidable as was sending manufacturing to the developing world. In 1970 one in four Americans worked in manufacturing, whereas today it's fewer than one in ten. The flight of routine computing work will likely follow a similar pattern. Technical skill is important, but a technical education on its own will not automatically ensure employment in the Second Machine Age.

That said, the value of getting a high-quality STEM education, not one limited to learning computer programming languages, but a rigorous grounding in one of the hard sciences or fields of engineering, should not be contested. Work in pure scientific research, as well as in R&D in industry and at the high end of technological innovation, will likely always be secure. Regarding computer programming jobs, there is a current shortfall of candidates to fill them in the U.S. labor force, and the pace of change is rapid. In addition, analysis of the future needs of the job market has indicated that this shortfall will worsen significantly in the coming years. The Bureau of Labor Statistics approximates that there will be one million more computer science job openings by 2020 than domestic candidates qualified to fill them. This is a driving force behind the calls for more STEM majors, and we can't deny that there is a very real need for more techies.

Certainly, more proficiency in the skills needed should be developed, and we might look to countries like Estonia that mandate all first graders learn to code. But the emphasis should *not* be on teaching these skills exclusively, and not only on this nearer-term skills gap. Those being taught the STEM skills should also be afforded the opportunity to develop the proficiencies fostered by the liberal arts, which will make them more agile and employable workers in tomorrow's economy. For example, Ireland's president Michael Higgins said in November 2016 that "the teaching of philosophy is one of the most powerful tools we have at our disposal to empower children." Rather than training legions of people to perform narrowly prescribed vocational tech tasks, we should be balancing this with a liberal arts education that develops more rounded skills and wider perspectives, instilling strengths in both the technical and the fuzzy abilities. The debate over STEM versus liberal arts has obscured the fact that the so-called pure sciences, such as biology, chemistry, physics, and mathematics, are a core component of the liberal arts canon, and that computer science has in many cases also been added to the canon. A false dichotomy has been established between liberal arts and STEM education; students can very well get both at once.

Barriers to Entry Are Falling

But what exactly is the value of a liberal arts education, especially if someone wants to meaningfully participate in pushing the boundaries of the frontiers of technological innovation? Are liberal arts majors truly shut out from the exciting possibilities of the future? A number of misconceptions are involved in that argument. The first part of the discussion includes an overlooked yet rapidly progressing development in technology where well-educated people who are not schooled in the STEM fields can now nonetheless play important roles, and even take the leading role, in applying new technologies to innovating products and services, like Katelyn Gleason achieved so successfully. As her story shows, though gaining literacy in the tech tools is important, a technical degree is not required anymore in order to thrive in many areas of today's tech-driven economy. The barriers to entry for harnessing the power of various technological tools have also been brought so low that those with no technical expertise are now able to gain that literacy much more easily and to collaborate more creatively and efficiently with technology experts while actually driving the innovation of new products and services.

One of the predominant trends in technology over recent decades has been the "democratization" of the tools used for creating technologically based products and services. Tech experts have provided increasingly intuitive interfaces that have rendered using computers so easy that three-year-olds can make their way around an iPad with ease. The emerging voice interfaces, such as Apple's Siri and Amazon's Echo, will continue to improve and will enable nonprogrammers to train and instruct computers to perform many tasks that once required programming. Even now, websites can be built without any programming knowledge whatsoever. Anyone

can become a web designer by simply selecting a template and then tailoring it as they like by dragging predesigned elements into it. These sites can also be easily connected to payment services, inventory control systems, and customer relationship management systems. While 3-D printing sounded like a futuristic fantasy just a decade ago, powerful printers are now available to the public at low cost and effortlessly programmed to create any manner of objects, such as custom-designed furniture and clothing. Even just a few years ago, building and maintaining the capacity to store the large volumes of data required for many types of tech-based businesses was prohibitively technical and expensive for all but the savviest of people who came up with an idea for such a business. Now, one need not understand the technical details about how servers work to purchase cloud-based data storage on Amazon Web Services. This isn't to say that all of today's technology tools are effortlessly available; many still require a high level of expertise to make use of them. But in those cases, resources abound for gaining that expertise more readily, and the trend of democratization will continue.

A few years ago, my seventy-year-old father crashed his Litespeed bicycle at over twenty miles per hour and landed on his head, ending up in the intensive care unit with a subdural hematoma. His neurologist recommended as part of his recovery that he undertake a regimen of brain training using Lumosity. This web-based company provides engaging, gamelike exercises for building skills in language, computation, memory, and logic. My father accessed the exercises through Lumosity's mobile phone app, and he enjoyed the experience so much that he was inspired to create an app of his own. He is an industrial psychologist who earned a master's degree from Virginia Commonwealth University, who was not a trained programmer, but he taught himself how to use a programming language called LiveCode, and quickly

began creating a working prototype for the product he wanted to build. Using a freelancer website called UpWork, he hired an iOS developer in India to help him. My father released a player-ranking iPhone application just in time for the 2014 FIFA World Cup. He is a shining example of how anyone who is motivated to participate in innovation in this emerging era can do so without any formal technical training. Though my father opted to learn LiveCode, an evolution of a very early Apple Mac program called HyperCard that he'd experimented with decades ago, it certainly wasn't required, and throughout this book, we'll hear the stories of many other nontech-schooled liberal arts graduates spearheading exciting innovations that have the potential to significantly enhance our lives by collaborating with techies to harness the power of sophisticated new capabilities.

The Liberal Arts Skills

While majoring in computer science isn't a requirement to participate in the Second Machine Age, what skills do liberal arts graduates specifically possess to contribute to this brave new world? Another major oversight in the debate has been the failure to appreciate that a good liberal arts education teaches many skills that are not only valuable to the general world of business, but are in fact vital to innovating the next wave of breakthrough tech-driven products and services. Many defenses of the value of a liberal arts education have been launched, of course, with the emphasis being on the acquisition of fundamental thinking and communication skills, such as critical thinking, logical argumentation, and complex problem solving. Fareed Zakaria, in his 2015 book *In Defense of a Liberal Education*, highlights "creativity, problem solving, decision making, persuasive arguing, and management" as the skills taught in the liberal arts. He makes a strong case. But the argument

about the general thinking skills that are developed has bypassed attention to what may be the most important factor in why liberal arts majors are particularly well equipped to take leading roles in current and future innovation.

One aspect of liberal arts education that has been strangely neglected in the discussion is the fact that the humanities and social sciences are devoted to the study of human nature and the nature of our communities and larger societies. Students who pursue degrees in the liberal arts disciplines tend to be particularly motivated to investigate what makes us human: how we behave and why we behave as we do. They're driven to explore how our families and our public institutions—such as our schools and legal systems—operate, and could operate better, and how governments and economies work or, as is so often the case, are plagued by dysfunction. These students learn a great deal from their particular courses of study and apply that knowledge to today's issues, the leading problems to be tackled, and various approaches for analyzing and addressing those problems.

The greatest opportunities for innovation in the emerging era are in applying evolving technological capabilities to finding better ways to solve human problems like social dysfunction and political corruption; finding ways to better educate children; helping people live healthier and happier lives by altering harmful behaviors; improving our working conditions; discovering better ways to tackle poverty; improving health care and making it more affordable; making our governments more accountable, from the local level up to that of global affairs; and finding optimal ways to incorporate intelligent, nimble machines into our work lives so that we are empowered to do more of the work that we do best, and to let the machines do the rest. Workers with a solid liberal arts education have a strong foundation to build on in pursuing these goals.

One of the most immediate needs in technology innovation is to invest products and services with more human qualities, with more sensitivity to human needs and desires. Steve Jobs brilliantly recognized this, and he created one of the most highly valued companies on the planet by focusing intensively on that mission. Companies and entrepreneurs that want to succeed today and in the future must learn to follow his lead and consider in all aspects of their product and service creation how they can make use of the new technologies to make them more humane. Jobs drew, in particular, on the insights of the humanities discipline of design. The Macintosh was the first computer to offer users a selection of beautiful typography, which Jobs learned an appreciation of by taking a course in calligraphy at Reed College, in Portland, Oregon. In his Stanford commencement address, he described typography as "beautiful, historical, artistically subtle in a way that science can't capture."

Still, many other liberal arts disciplines also have much to provide the world of technological innovation. The study of psychology, for example, can help people build products that are more attuned to our emotions and ways of thinking. Consider the runaway success of Facebook to appreciate how expertise in understanding "the human factor" can make a difference in the creation of new products, programs, and services. Most of us know Mark Zuckerberg as the lightning-fast coder who lacked social skills and had a hard time with interpersonal relationships. What's been overlooked is that he was a liberal arts student at Phillips Exeter Academy, where students learn around "Harkness tables" and teaching happens through the Socratic exploration of ideas rather than through lectures, and then at Harvard University, where he loved learning Latin and Greek. He even aced an art history final by creating a website that displayed two hundred works of

art and allowed his fellow students to offer their comments about the works' importance, an early crowd-sourced study platform. Like his older sister Randi, he studied psychology, and in building Facebook, he applied insights about the innate human desire to connect with one another. While Zuckerberg also possessed prodigious coding skills that allowed him to spearhead Facebook's early development, he tapped into human psychology with Facebook.

Experience in anthropology can additionally help companies understand cultural and individual behavioral factors that should be considered in developing products, and in marketing them. In a newspaper interview a few years ago, Florida governor Rick Scott said he was seeking to shift state funding away from support for people obtaining degrees in psychology and anthropology and toward support for education in the STEM disciplines, remarking, "Is it a vital interest of the state to have more anthropologists? I don't think so . . . If I'm going to take money from a citizen to put into education, then I'm going to take that money to create jobs." Prior to giving that speech Scott ought to have made note of a study by the U.S. Department of Labor that estimated strong job growth for anthropologists, over the average rate of growth for most professions, and on par with the current growth rates for computer software engineers.

Anthropologists in Self-Driving Cars

Carmaker Nissan has enlisted Melissa Cefkin, a PhD anthropologist from Rice University, to evaluate its design and lead company research into human-machine interaction at the Nissan Technical Center. Currently, she leads a team investigating the complexities of the ways in which self-driving cars and humans will likely interact and what the implications of those complexities are for how the cars should be designed and controlled. To consider why her

input is necessary, let's take a brief look at the prospects, and the potential pitfalls, of self-driving vehicles.

The engineering feat of getting this technology deployed has been a stunning accomplishment, but many thorny questions remain to be answered about safety. In 2016, the tragic death of a driver of a Tesla car equipped with autonomous navigation autopilot technology highlighted the current limitations automotive designers face when accounting for all dangers. His death occurred in the least complex driving environment—the open highway—when autopilot failed to detect that a tractor-trailer was switching lanes, moving in front of the Tesla. Analysis later revealed that the truck's white body was eclipsed against a bright spring sky. The driver may have failed to spot the truck because he had put his faith in autopilot, taking his eyes off the road to watch a Harry Potter movie. Experts agree that as of yet, many situations that autonomous vehicles might encounter on roads are beyond their ability to safely navigate, such as flooded roads, large potholes, road debris, and temporary traffic controls, for example, detour signs. Now, Cefkin is studying the challenges of self-driving cars navigating within our even more crowded and inherently unpredictable, nonroutine, and complex urban environments.

Dealing with mixed human-machine environments is one of the most difficult challenges facing autonomous car designers today. Ultimately, these environments may be homogenously machine-operated, but for the foreseeable future, these environments will be pluralistic. Where machines could be programmed to be efficient and rule-abiding, humans are messy rule-breakers who analyze situations on a case-by-case basis using a complex set of interpretations that are hard to teach to a machine. Take a busy intersection with stop signs but no stoplights: cars proceed in a way that is determined less by rules than by subtle choreography

on the go—a hand wave here, a rude gesture there, some inching forward by the especially eager motorists. Anthropologist Edward Sapir wrote about the nuanced human communication system of gestures, which is "an elaborate and secret code that is written nowhere, known by none, and understood by all." An autonomous vehicle can't yet perceive and understand gestures. The machine knows only to stop at the sign; it's up to Cefkin to figure out what it should do from there and how to manage the complex dance that is human interaction.

To do that, Cefkin needs to identify patterns in human behavior that can help programmers understand how autonomous cars ought to behave on the road. In searching for those patterns, she's borrowing many tools from the world of anthropology—such as the ethnographic practices of close observation of people out in the field and videography of their behavior. A main goal is to help Nissan design a communication system for autonomous cars in interacting with pedestrians and other drivers. Color-coded lights might signal the car's intent to start or stop or stay in place, while some kind of ocular apparatus could be created to let people know whether or not the car is aware of them. Perhaps a video screen can be placed on the front of the cars so that text could be displayed, communicating the messages hand signals once did. In addition to these communication issues, figuring out how autonomous vehicles can be safely introduced to our roads will require accounting for the psychology of drivers, such as some people's irritation when a car is driving slower than the speed of traffic in the "fast lane," not to mention road rage. According to Hans-Werner Kaas, a senior partner at McKinsey & Company, "There is an increasing awareness across all automakers that they have to deal with the psychological issues of these vehicles. They're beefing up their skillset."

Mapping out the myriad logistical issues that must be tackled is only the beginning of making self-driving cars viable. Many complex ethical issues remain. A June 2016 *Science* article entitled "The Social Dilemma of Autonomous Vehicles" rigorously engaged the modern relevance of a 1967 thought experiment put forth by British philosopher Philippa Foot, known as the "trolley problem." In the problem, a trolley is barreling down the track toward five workers. Another worker looking on could switch the trolley to another track with a lever, but there is one worker on the other track. What should the worker operating the lever do? Self-driving cars present a similar conundrum. Should a car be programmed to privilege the lives of the driver and passengers over the lives of a pedestrian or a bicyclist who might veer into the car's path? If the car could avoid hitting someone by swerving sharply to the right, but would thereby crash into a retaining wall, or to up the ante, into a family of three waiting on a sidewalk for a light to change, what should the car do? Though these vehicles have been dubbed "self-driving," in truth (and as we'll discuss more in the next chapter), they are driving according to what they've been taught to do by programmers, chaperoned by code.

Should a car be "taught" to attempt an evasive maneuver in all such instances, but to calculate the risks to its passengers and swerve only as much as will also keep them from harm? Should it be programmed to respond the way the majority of humans do in such circumstances? Is there even a predominant way humans react in such circumstances, and if so, should that behavior be mimicked or optimized? Will programmatic judgment calls coded into software be "recalled" the way failing airbags might today? If the car is capable of a faster response and of calculating all options faster than a human and always selecting the one with the best odds of saving the most lives, then shouldn't laws mandate that the

car be programmed to do so, and that in all such circumstances, the car be in charge? Should the option for the human driver to take over the wheel be automatically disabled? Also, if self-driving cars are proven safer and more fuel-efficient, then should car companies be required to increase the pace of developing them? After all, we've required companies to accelerate the development of improving fuel efficiency and decreasing their carbon emissions. These questions only begin to scratch the surface of the issues that must be addressed in introducing these vehicles into our lives.

What if passengers are asked to tap "OK" to accept liability the same way that they might accept terms and conditions when downloading the latest ad-blocker software? Is this sufficient? Harvard psychologist Joshua Greene describes the root of the complexities in his article "Our Driverless Dilemma" in *Science*. Machine decision-making is "more philosophical than technical. Before we can put our values into machines, we have to figure out how to make our values clear and consistent," he writes. For the young ethicists and litigators out there, welcome to a burgeoning field of inquiry. The global law firm DLA Piper has already launched its "Connected and Self-Driving Car Practice," and thirty-three-year-old Elliot Katz, an American studies major from Vanderbilt University and lawyer trained at Cornell, is the global co-chair of the practice, already considering many of these questions.

Tapping Into Liberal Arts Grads

As technology allows for more machine intelligence and our lives become increasingly populated by the Internet of Things, and as the gathering of data about our lives and analysis of it allows for more discoveries about our behavior, consideration of how new products and services can be crafted for the optimal enhancement of our lives, and of the nature of our communities, workplaces,

and governments, will be of vital importance. Those products and services developed with the keenest sense of how they can serve our human needs and complement our human talents will have a distinct competitive advantage.

This is why Tinder, the fast-growing dating service, employs sociologist Jessica Carbino, a PhD from UCLA, to help the company understand patterns in matching. Some might see Tinder as a vapid hookup app where users swipe left or right based on their attraction to another user. But to the inquiring social scientist, it's also a vast data trove about human attraction, sociology, and psychology. For example, Carbino has billions of data points from which she can learn about "thin slicing," the term for nonverbal cues people employ in quick decision-making. Data shows, for example, that women find men with softer jawlines kinder, whereas men find women who wear makeup to be more attractive. With 15 percent of American adults on dating apps, many more discoveries about our ways of evaluating a person's appeal and about the intricacies of dating are sure to be made. Tinder is hardly the only company tapping the talents of liberal arts graduates to make products more appealing and effective.

For example, Nathan Jurgenson was a PhD sociology student at the University of Maryland, writing his thesis on "surveillance on social media" from Brooklyn, when he caught Snap founder Evan Spiegel's attention all the way in Los Angeles. Nathan had written on "digital dualism," pointing out the fallacy that the world is "real" while the digital world is "virtual." He put his finger on the sociological reality that to the extent that the real world was stage-dressed for Instagram, it was perhaps more virtual than an authentic digital alternative. The alternative that was ephemeral, transient, and, therefore, more authentic was Snapchat. Younger generations were tired of the artifice behind the art of sharing.

Snapchat was straight talk, and in the age of endless storage and digital abundance, it created scarcity. Spiegel adopted this notion of deconstructing digital dualism and hired Jurgenson. Today Jurgenson is an in-house social media critic, and the editor of the Snap-funded online magazine called *Real Life*, which publishes essays about living with technology.

The wildly successful corporate communications startup Slack, which offers software that allows employees on a team to communicate more efficiently than with email, employs theater majors to help make the messages Slack sends to users more engaging. Just as Siri offers humorous or sassy responses when you pressure her for particular answers, such as "Perhaps you're right," said in a droll tone, Slack's chat bots seek "to provide users with extra bits of surprise and delight" by providing unconventional responses. Editorial director Anna Pickard, a theater major from Manchester Metropolitan University in England, cooks up these kernels of whimsy. When you join Slack as a new user, rather than input your data into fields, you simply "chat" with a friendly bot that asks you for your relevant details. Similarly, Wade and Wendy is a company creating a chat bot powered by artificial intelligence that aims to streamline hiring conversations between candidates and recruiters. Its programmers attempt to codify fluid conversations into static code based on the research and analysis provided by Tommy Dyer, an in-house organizational psychologist who got a very classical liberal arts education based on reading original texts at St. John's College in Annapolis, Maryland.

Much of the criticism of the liberal arts is based on the false assumption that liberal arts students lack rigor in comparison to those participating in the STEM disciplines and that they are "soft" and unscientific, whereas those who study STEM fields learn the scientific method. In fact, the liberal arts teach many methods of

rigorous inquiry and analysis, such as close observation and interviewing in ways that hard science adherents don't always appreciate. Many fields have long incorporated the scientific method and other types of data-driven scientific inquiry and problem solving. In development economics, for example, students are taught about conducting randomized control trials that test policy interventions with much the same rigor as clinical medical trials, with groups like the Poverty Action Lab at MIT and the Innovations for Poverty Action at Yale leading the way.

Sociologists have developed sophisticated mathematical models of societal networks. Historians gather voluminous data on centuries-old household expenses, marriage and divorce rates, and world trade, and use data to conduct statistical analyses identifying trends and contributing factors to the phenomena they are studying. Linguists have developed high-tech models of the evolution of language, and they've made crucial contributions to the development of one of the technologies behind the rapid advance of automation—natural language processing, whereby computers are able to communicate with the accuracy and personality of Siri and Alexa. When venture capitalist Vinod Khosla asserted, as he did in a widely circulated 2016 *Medium* post titled "Is Majoring in Liberal Arts a Mistake for Students?," that a liberal arts education limits "the dimensionality of your thinking since you have less familiarity with mathematical models . . . and worse statistical understanding," he neglected to account for how widely these methods of inquiry are being taught to liberal arts majors.

It's also important to debunk the fallacy that liberal arts students who don't study these quantitative analytical methods have no "hard" or relevant skills. This gets us back to the arguments about the fundamental ways of thinking, inquiring, problem solving, and communicating that a liberal arts education teaches, made

by Fareed Zakaria among many others. Part of the problem with the misunderstanding about how rigorous the development of these skills can be derives from mischaracterizations of how rarefied, or esoteric, the liberal arts subjects are. Critics love to trot out what *New York Times* writer Charles McGrath called "apocryphal stories" of students "who are expert in the erotic subtext of pre-World War I Croatian folk dance." My father used to warn my sister and me about majoring in "basket weaving." Fortunately, we chose comparative literature and political science instead. In truth, one of the hallmarks of liberal arts education is that students are encouraged, if not required, to study a broad range of subjects, either through a core curriculum that all students must take, or more commonly through taking a number of electives that complement their work in their major.

Specialization is a feature of graduate education in the liberal arts disciplines, not of undergraduate studies. An irony about this criticism is that it is actually in the STEM fields that specialization is more of a problem, with the course loads for many degrees leaving little room for wider-ranging pursuit of intellectual passions or simple curiosities. What's more, computer science programs often churn out graduates who are not versed in the coding languages that will make them effective programmers today. The languages one needs to know to do product development rapidly change. Many such students require additional online training. In fact, Zach Sims, a political science major at Columbia University, cofounded Codecademy, which offers online programming classes, specifically because of this failure of traditional programs. "We found that you can be a good Computer Science major, but not a good programmer. So early on we interviewed people for Harvard and MIT and realized that they might not be the best hands-on programmer," he explained in 2013. Former president of the Col-

lege of Wooster in Ohio and a senior fellow at the Council of Independent Colleges, Georgia Nugent noted in an article for *Fast Company*, "Why Top Tech CEOs Want Employees with Liberal Arts Degrees," that with technology evolving so fast and the needs of businesses shifting in unpredictable ways, "it's a horrible irony that at the very moment the world has become more complex, we're encouraging our young people to be highly specialized in one task. We are doing a disservice to our young people by telling them that life is a straight path. The liberal arts are still relevant because they prepare students to be flexible and adaptable to changing circumstances." In our ever-faster-changing world, the demand for intellectual agility, creativity, and the curiosity to explore new terrain is higher than ever.

A core aim of liberal arts education is to allow students to pursue their passions, and also to enable them to discover passions. Exposing students to new areas of scholarship and to other cultures, belief systems, methods of investigation and argumentation is at the heart of this mission. The ideal is that a broad liberal arts exposure tugs on the mind, forcing a student to consider positions and opinions that make him or her question perspectives and biases, often fueling late-night debates with classmates. Students are encouraged to select a major based on their intellectual interests as much as, if not more than, on a clear idea of the field of work they will ultimately pursue. A student may enter college expecting to major in economics or English literature, but take a class in urban sociology as an elective and discover an intense interest in urban planning, perhaps deciding to go into urban studies and a career in city planning or government. Perhaps that student will one day bring that knowledge to collaborate with technology experts in order to innovate an efficient urban transportation system

that incorporates driverless vehicles, or will consider how demographic analytics could better price real estate.

Central to the philosophy of a liberal arts education is that we may not discover our strongest interests, and the work we would like to devote ourselves to, without exposure to a broad range of knowledge and ways of thinking, and to investigation of the nature of our world and of problem solving. A liberal education is not so much about learning to do a job as it is about learning to learn, and to love learning. It is both about intellectual adventure and about building the fundamental intellectual skills that equip students to continue to pursue new interests for the rest of their lives, whether or not they have a formal education in those pursuits. These fundamental skills—critical thinking, reading comprehension, logical analysis, argumentation, clear and persuasive communication—also prepare students very well for work life.

Georgia Nugent reported in an August 2015 essay for the Council of Independent Colleges that "time and again, graduates in all walks of life (from corporate leadership to crime prevention, from diplomacy to dentistry, from medicine to media) speak passionately of the value of having been introduced to art, anthropology, philosophy, history, world religions, literature, languages—no matter what their college major or their career path. In fact, they often attribute the success they have attained to this undergraduate exposure to many different modes of thought." The innovation of technology-driven products and services also belongs on that list. In a July 2015 *Forbes* article by George Anders, Slack's Butterfield admitted that philosophy taught him well. "I learned how to write really clearly. I learned how to follow an argument all the way down, which is invaluable in running meetings. And when I studied the history of science, I learned about the ways that every-

one believes something is true—like the old notion of some kind of ether in the air propagating gravitational forces—until they realized that it wasn't true," he recalled.

The development of these foundational skills is the reason that so many employers are intent on hiring liberal arts graduates, despite the dire warnings of certain tech titans. In a survey published in *Liberal Education* in 2013, 74 percent of employers polled responded that a liberal arts education "is the best way to prepare for success in today's global economy." Employers in the technology sector are very much included. LinkedIn, which owns a treasure trove of data about what kind of people are being hired for which jobs, conducted a study in 2015 revealing that "liberal arts grads are joining the tech workforce more rapidly than technical grads. Between 2010 and 2013, the growth of liberal arts majors entering the technology industry from undergrad outpaced that of computer science and engineering majors by 10 percent."

Companies need intellectual dexterity as much as they need technical expertise. Staying competitive with the pace of innovation today demands it. We'll see again and again in this book how people who earned "fuzzy" liberal arts degrees made bold leaps into totally unknown terrain, connecting the dots between fields, perceiving problems overlooked by experts, and feeling confident in their ability to get up to speed with whatever knowledge they need in order to push forward with an innovative idea. This is not to say that only a liberal arts education fosters this dexterity; many of those who train in technical fields are immensely creative. The point is that a liberal arts education actively encourages such abilities and is of equal importance.

For years, many leading firms in Silicon Valley have been hiring large numbers of staff with little or no technological knowledge, and often no prior experience working at a tech-based company, to

bring their expertise in design, sales, brand building, and customer relations management to product development and marketing. What's new today is how fuzzies are playing central roles in coming up with many of the most creative and successful new business ideas and driving core product development. Some of them are applying the specific methods of investigation and analysis they learned in their major field of study, whether economics, sociology, linguistics, or psychology, and some of them are doing work they had no special training for, like Katelyn Gleason. Fuzzies are helping to bridge divides between specialties, making unexpected connections between problems and the technological means of addressing them, and building the cross-functional teams required to pursue the most promising areas of innovation. They are sharing vital insights about how the human factor can and should be accounted for, and how the new technologies can be best used to improve our lives.

The most exciting and influential innovations today—those referred to as "zero to one" innovations by influential startup investor Peter Thiel in his 2014 book with Blake Masters called *Zero to One*—are arising from the merging of fuzzy and techie expertise, producing more powerful ways to solve the most important problems across a wide range of domains like education, health care, retail, manufacturing, policing, and international security. As Mark Zuckerberg argued in an August 2016 interview with Y Combinator president Sam Altman, "I always think that you should start with the problem that you're trying to solve in the world and not start with deciding that you want to build a company . . . The best companies that get built are things that are trying to drive some kind of social change." These innovators are improving the ways in which we foster our children's engagement in learning. They are harnessing knowledge of human psychology and the powers

of persuasion to make headway in preventive medicine. They are helping to make government more transparent and democratic, and facilitating higher-quality and more efficient interpersonal communication. Innovators are tapping the potential of the deluge of "big data" and ingeniously making use of the power of such cutting-edge technologies as natural language processing and machine learning. And this era of transformative innovation has only just begun.

Opportunities abound, but so do threats. Any business that is not purposefully spearheading better collaboration between its fuzzy and techie staffs—bringing in people with the right set of skills in understanding the human factor and the possibilities of the new tech tools—risks rapid obsolescence. As leading business strategy specialist Michael Porter wrote with James Heppelmann in the *Harvard Business Review* in 2015, "The evolution of products into intelligent, connected devices . . . is radically reshaping companies and competition," requiring the evolution of new business models and collaboration across the tech and nontech functions.

Every able-bodied working person wants to stay relevant as this wave of innovation builds; college students considering their careers; parents who want to steer their children to success; and entrepreneurs and corporate managers, no matter what sector, must understand the extraordinary potential of merging the fuzzy with the techie. While the rise of robots has been persuasively heralded, the Second Machine Age is less about machines taking over human roles than it is about humans making machines better serve us.

TWO

Adding the Human Factor to Big Data

On May 2, 2014, the USS *Blue Ridge,* the command ship of the U.S. Navy's Seventh Fleet, was on patrol in the treacherous waters of the South China Sea. Intelligence detected what looked to be a large hive of vessels in the area known as the Vietnamese exclusive economic zone (EEZ). The data from an intricate web of surveillance devices deployed in the region was displayed on the Global Command and Control System–Maritime (GCCS-M), or "Geeks."

Andreas Xenachis was on duty that day, leading six analysts on a "watch floor," the term for the rotating groups that monitor and analyze the flood of data coming in from the larger fleet C4I—which stands for command, control, communication, computers, and intelligence—operation. His team was responsible for keeping apprised of all data on Geeks, which meant a complex dance of receiving, retrieving, and displaying data about ship movements, satellite data, radar signatures, and newswires. They were also responsible for providing the fleet commander a first-line situational awareness of what the data was indicating and the possible danger to any of the eighty ships, hundreds of aircraft, and tens of thousands of people under his command.