Building Post Roads of a New Millennium

You are the smartest class to have graduated from the University of Pennsylvania since the College of Philadelphia gave its first eight baccalaureate degrees in 1757. No, I mean it. And now that I’ve said that, I’m tempted just to sit down. But I’m going to take the risk of explaining why I’m pretty sure I’m right. And when I’m done you’ll see that this is as much a reason for humility as for pride.

To explain what I have in mind, let me take you back a century before the College opened its doors, back, in fact, to 1654. We’re in France and Antoine Gombaud, chevalier de Méré, a gambling gentleman, has had a run of very large losses. Nowadays, I suppose, he’d have entered a 12-step program at Gamblers Anonymous, but that wasn’t an option then. So, instead, being a chevalier, he simply wrote to France’s two leading mathematicians, Pierre de Fermat and Blaise Pascal, and asked where he had gone wrong. That got the two great mathematicians thinking, and they wrote each other a series of letters that year, which were published a couple of years later by Christian Huygens in Holland. In those letters they invented the foundations of the modern mathematical theory of probability.

The seventeenth century was actually a pretty good period for mathematics overall. Not only do you have John Napier, Laird of Merchiston, inventing the logarithm, but you’ve got René Descartes, in an appendix to his 1637 Discourse on Method, named simply “La Géométrie,” laying out the foundations of analytical geometry (which is why those coordinates are called Cartesian). And then, in the last part of the century, Newton and Leibniz developed the calculus, pretty much independently, drawing, of course, on the ideas of Descartes and Fermat and the other leading mathematicians of the first part of the century. Logarithms, probabilities, infinitesimals, differential equations. The intellectual firmament was changed forever.

Now Fermat was usually in Toulouse, Leibniz in Hanover, Newton in Cambridge, Huygens in The Hague, Pascal in Paris, and Descartes (who served in the Dutch and Bavarian armies) was all over the place, but most often somewhere in the Netherlands. They knew Latin, but they spoke English, Dutch, French and German. And to figure out how they could nevertheless have been part of an intellectual community, you have to think about something else that happened in the seventeenth century.

In 1635, in England, a proclamation permitted the public to use the Royal Mail, which had hitherto been a means of conveying only letters between the King and members of his Court. The conveyance of private letters by the royal poste aux chevaux took off when its finances were put in order in 1627. Before long, thoughts that nobody had had before were being thought. We talk about these great thinkers as if they did it on their own, as individuals. “Nature and nature’s laws,” Alexander Pope wrote, “lay hid in night. / God said,” “Let Newton be!” and all was light.” That’s highly misleading. New thoughts really emerge from collections of individuals and things. There is indeed a space where new thinking happens, but it’s not really between anybody’s ears.

What are the chances of your rolling seven with two dice? It seems that before the seventeenth century, nobody had a clue. Then, in the mid-seventeenth century, in the space between Toulouse and Paris and The Hague—a space connected by the mails as much as by stagecoaches—the answer was discovered. And now every one of you knows how to work out the answer. (Right? Ah well, it’s too late to test you now.) In the letters between Pascal and Fermat, we find glimmerings of a whole new way to understand uncertainty. Imagine what might have happened if they’d been able to IM each other as well! Fermat, scribbling in the margin of a book, wrote about the most famous theorem that bears his name, “I have discovered a truly marvelous proof of this, which this margin is too narrow to contain.” In contemporary terms, it’s as if he was tweeting his friends, as were reaching his 140-character Twitter message limit. As the mails became more accessible, midway into the early modern era, you sense a similar excitement.

The expansion of post roads continued to be a good proxy for the expansion of knowledge. The postmaster of Philadelphia was, of course, your own Benjamin Franklin. By 1775, he became this country’s first postmaster general, and put the system on excellent foundations, too. Those post-roads connected the minds of America into a web—a web that was connected, across the Atlantic, with the webs of the Royal Mail and the posteaux aux chevaux.

The late historian of science Derek De Solla Price devised a way of trying to quantify the growth of scientific knowledge. He saw a more or less exponential curve. Human knowledge doubles in the 1500 years between the birth of Christ and the Renaissance; it doubles again in the 250 years between the Renaissance and the French Revolution; and again, between the French Revolution and the dawn of the automotive age, 125 years later, and again between then and the start of the Cold War, another 50 years; then it doubled in the decade preceding the election of JFK. Now—by some estimates—it doubles every two years. Soon, it looks like, someone will be able to tell you that it has doubled in the course of a graduation ceremony.

This should remind you of Moore’s Law, which suggests that, holding unit costs steady, the processing power of an integrated circuit doubles every two years. The computer can be thought of as a cognitive prosthesis. Since Moore’s law was coined, it has been observed that per-person productivity improvements in DNA sequencing follow more or less the same plot. Likewise when it comes to how long it takes, in man-hours, to determine a protein structure. So biological technology has gone into overdrive, too. In theory, the time it takes to go from “bug to drug”—from identifying a pathogen to devising a treatment for it—can be reduced from a decade to a matter of weeks.¹

Given all this, given the acceleration of connectivity and computational power, yours will be the smartest generation so far: the most networked, the most cosmopolitan, the most intellectually powerful. Your computer connects you with millions of gigabytes of data; but equally importantly it connects you with millions of human minds. In the space among all of you, amazing things are going to happen. Not because you’re individually smarter than Newton, but because you have better tools and you’re better linked up than he was. The intellectual capital tied up in the brains of each human being can now potentiate the capital in all the others. The genius of modern science isn’t that we’ve figured out how to make more scientific geniuses. It’s that we’ve worked out how to take normal human beings and link them up in institutions where they can develop new understandings by challenging old ideas. You’re the smartest generation because other people have built the tools and the resources that make you smarter: the world wide web, the cell phone that allows you to ask a question by IM or access a news site or a blog; the databases and the instruments that will make you productive in all you do at work and at home in the life ahead of you. And in that life you’ll be creating things that will help other people to be smarter, too—even smarter than you, if that’s possible to imagine. You’ll be building the post roads of a new millennium.

But to make the best use of your shared resources you have to keep yourself open to the possibility that you’re wrong. That web of information that you tap into everyday is a web of misinformation, too: and you’ll need to remember not just that every time the Internet challenges you with a new idea, it may be right; but also that every time it confirms what you already thought, it’s possible that you and it are both wrong. Human knowledge, it has been suggested, is itself a Wiki, a collective, ever changing edifice: constantly expanding, constantly being corrected, and constantly in need

1 Rob Carlson, “The Pace and Proliferation of Biological Technologies” www.kurzweilai.net/meme/frame.html?main=articles/art0614.html (continued on next page)
of correction. Part of why a rigorous education, such as you’ve received at Penn, matters so much, is that it aids the self-correcting function. Education is as much about teaching you to identify falsehoods as it is about teaching you truths. Bad ideas—not least, violent fanaticisms—can travel along the post roads of our postmodernity, too. They have done so. But such ideas hate to be exposed to the rough-and-tumble of debate; they fear exposure to other ideas, other beliefs. Apocalyptic fantasies will persist, I have no doubt; but there’s reason to hope they will not prosper.

When I was an undergraduate, my biochemistry tutor gave me a print of one of Carpaccio’s great murals of St. Jerome. Years later, looking at the original in Venice, it struck me that the shelf of books behind the saint—his library—contained almost everything that he would have thought worth reading, and he would surely have read all of them. Now, a single web site may contain millions of times the number of pages that St. Jerome could have read in his lifetime. Once, to have heard the range of music that you can scan on your radio, you would have had to travel thousands of miles, hoping to be on time for the right performances. Your DVD collections may well contain more hours of acting than Samuel Pepys—that devoted seventeenth century theatergoer—saw in his entire lifetime. There used to be a time when the proof of a new mathematical theorem was a rare and noteworthy event; and now? Well not so long ago, a distinguished mathematician suggested that more than one hundred thousand new mathematical theorems were now being proved each year. The next Enlightenment is yours for the making, together.

The gains I’ve talked about so far are mathematical, scientific, and technological. What about moral gains? Given everything our species has learned about historiography, literature, engineering, sociology, molecular biology, algebraic topology, and the rest, why haven’t our ethical attainments kept pace? If we’re so good at math, why haven’t we become whizzes at morality? Certainly, it can be discouraging to think about the persistence of cruelty and carnage in our own day. Yet here, too, there are reasons for hope. Two hundred years ago, on March 25, 1807, the British Parliament passed the Abolition of the Slave Trade Bill. Within a single generation, Britain went from being the world’s leading slave traders, with more than 50,000 slaves shipped every year, to banning the trade, and then the practice of slavery across its empire—and it did so at a time when there was still a great deal of profit to be made. It was a startling turn-around within one generation. Or think of foot-binding in China: a practice that was entrenched for a millennium but was, in one generation straddling the turn of the past century, essentially eradicated. Our own country lived with routine everyday legal apartheid for most of its history; but then, in the 1950s, the Supreme Court insisted that the very idea of enforced separation was repugnant, and in the decade that followed, federal laws promulgated that core idea. People born since Brown v. Board of Education—even if they came from families with long histories of racism—now almost all accept that racism is wrong. But, as with the scientific advances, the work here has always been a social endeavor: not the possession of a solitary mind, but something that emerges out of an extended human horizon. People didn’t learn that forcible segregation was wrong by sitting alone and pondering the question: they learned it was wrong by arguing about it together, by seeing together what it meant in a social world they shared. And by making arguments, together, they changed the world.

And so the challenge is not only to create a smart society, with smart institutions, which can be organized to bring more and more of the population of this world on-line, so to speak. It is also to advance the great collective project of moral understanding. We each have a part to play. If the great conceptual breakthroughs of the seventeenth and eighteenth-centuries, the West’s first Enlightenment, were partly to do with an expanded postal service, then the people who helped build a post road—the surveyors, the engineers, the fellows who designed the shovel, the plow, and the rake, and the fellows who wielded them—all were part of that revolution of thought, too.

One mark of the dawn of our modernity, I suggested at the start, was a new way of understanding uncertainty. The results helped gamblers like Antoine Gombaud lay down bets that still had no guarantee of success but at least enjoyed better odds. Yours will be an age of intellectual abundance, such as the world has never seen, and you face challenges such that the world as never known—problems that, alas, your elders have bequeathed you as well. There’s no guarantee of success. But, in the spirit of the chevalier de Méré, and speaking for my own generation, I’d like to say, “We are betting on you.”

Amazing Grace

When Ian Samuels, from Tenafly, New Jersey, came to Penn as a freshman, he could not have foreseen joining Professor Ian McMillan’s Societal Wealth Program and writing software that supports medical clinics in Botswana.

Nor did Terra Gearhart, who came from Albuquerque, New Mexico, see herself tutoring at West Philadelphia’s Lea School for four years while she starred for Penn Dance, mastered Aristotle, and developed such a great an pas...
Penn Commencement Address by President Amy Gutmann, Monday, May 14, 2007.

Taking the Environmental High Road

Chairman Riepe, Trustees, honorary degree recipients, honored guests, parents, families, friends, survivors of Senior Week … and all returning alumni: It is my great privilege to welcome you to the 251st commencement of the University of Pennsylvania! John Masefield wrote, “There are few earthly things more beautiful than a university.” Let’s hear it for the great, beautiful class of 2007!

Graduates: You have secured your place in Penn history … as the class that saved Hey Day! There is a lot of love radiating right now from the stands of Franklin Field. Graduates, I am sure the feeling is mutual. How about cheering your parents, families, and partners?

Commencement itself celebrates the timeless beauty of knowledge and wisdom. But the world surrounding us is not timeless. Quite the contrary, its future is at risk. Scientists at Penn and around the world have demonstrated that global climate trends, if allowed to continue, will lead to an ecological catastrophe.

No task is more pressing or more capable of uniting us across many divides than managing our planetary health for the long term. That great philosopher Woody Allen reminded a graduating class more than a quarter century ago that humanity faced a similar crossroads. “One path leads to despair and utter hopelessness. The other, to total extinction. Let us pray we have the wisdom to choose correctly.”

Today—as we contemplate our environmental prospects—this is no joke. Future generations will face an increasingly grim tomorrow … unless we get smarter today about treating our environment with greater care. We do not have to rewire human nature in order to help our planet heal itself before it is too late.

Graduates: You have already set the healing process in motion. With passion and intelligence you have raised your collective voices, and Penn is taking the environmental high road toward fostering a sustainable future.

We are cutting energy usage during peak hours by nearly 20 percent. We are purchasing 30 percent of our energy from wind-generated power, making Penn one of the largest private purchasers of wind power in the nation. We also are a national campus leader in the adaptive reuse of existing buildings and materials.

Earlier this year, we signed an historic higher education pact to develop a comprehensive sustainability plan by 2009. We must and we will continue to do much more to help save our planet. We will transform ugly parking lots to our cast into beautiful fields of green. We will reuse stone and paving materials while choosing native plants for landscaping and storm-water management.

And we will be at the global forefront in converting our academic research into a host of practical solutions to environmental challenges.

We put a premium on environmental responsibility not to claim bragging rights, but rather because great universities have a duty to serve as leading agents of long-range thinking and action that will sustain humankind today, tomorrow, and for generations to come.

Graduates: You have already proved yourselves trailblazers for a more sustainable and more humane future.

Let’s hear it for Penn’s Engineers Without Borders, who have brought clean drinking water to a village in Honduras.

Let’s hear it for the Wharton trailblazers who are working to promote sustainable agricultural and economic development throughout the developing world.

Let’s hear it for the trailblazers from the College and Grad Ed who have formed close mentoring relationships with local public schoolchildren and made a lasting impact on their lives.

Let’s hear it for all of our Penn students who have spent spring, summer, and winter breaks helping the survivors of Hurricane Katrina rebuild their lives.

And each and every one of you leaves Penn better than you found it. Now, we ask you: Are you ready to step up … and become global stewards for a more sustainable and more humane world? Are you?

Achieving sustainability will not come easy. Differences and disagreements over how best to pursue common goals will inevitably arise. We can’t play down our differences—nor should we. That is part of the beauty of living in a free society.

We must resolve to work through our differences with a habit of mind—an attitude—that propels us to treat all of our neighbors—locally, nationally, and globally—all of our neighbors as we would like to be treated ourselves.

I am talking about a concept that Aretha Franklin has sung right into our souls with far more soul than any one else I know can muster. Shall I spell it out? R-E-S-P-E-C-T.

Ultimately, our planetary fortunes boil down to our ability to make mutual respect the natural order of our lives. We must cultivate respect for the values of science, which are too often distorted. We must demand respect for the dignity of every human being, which is too often denied. And we must learn to respect our earth by undoing the damage we have done to our soil, water, air, and biodiversity.

Today we honor lifetime achievements in medicine, science, the arts, the humanities, the law, and public service. Along the way, our honorees have earned prestigious awards—including the Grammy, the Lasker Prize, the MacArthur fellowship, the National Medal of Science, and the Presidential Medal of Freedom.

Graduates of the great class of 2007: There are Nobel Prizes and medals galore waiting for those of you who can solve the daunting issues of our times. There is also a planet dying to be saved for future generations.

While the world is waiting, our environment does not have the luxury of time.

But the world has you. You have the power to sustain the planet just as you will be sustained by the strength of your Penn education and the love of your friends and family.

Yes, we live in a beautiful world that deserves a longer lease on life. Make it happen! And remember: there are few earthly things more beautiful—and more alive—than the love of your extended Penn family. Godspeed!

Learning from and with Our Students

As the representative of the faculty, it is my privilege to offer you congratulations on a spectacular achievement: earning a degree from Penn. We, the faculty, and you, started our common journey as instructors and students, but we end it here as colleagues in learning. Indeed, I know that many of the faculty share my view that one of the great joys of teaching is being able to have the chance to learn from and with our students. We’ve shared each other’s thoughts and opinions. We’ve worked on research projects pushing at the frontiers of knowledge and we’ve shared in efforts which reach out to our surrounding community. Although we’ve shared so much, we, the faculty, are proud to see you, our students, go on to a lifetime of learning, achievement, and leadership. In that spirit, I would offer you just one last lecture.

It is typical of times like this that you hear inspirational words from the founder of our great university, Benjamin Franklin. Since his words have inspired me since early childhood, I could not choose a single quote to leave with you, so I’ve chosen to share with you several that have been important in my own life. These are words which inspire us to commitment and communication. First, Franklin states “All who think cannot but see there is a sanction like that of religion which binds us in partnership in the serious work of the world.” Commit yourself to doing that “serious work.” The world needs your talents; make it your destiny to share them freely and encourage others to do the same.

To share ideas freely, you must also communicate well. The democracy of our country cannot thrive without the voices and opinions of our young people. Franklin wisely reminds us that words and deeds speak equally loudly. To paraphrase him: “Either write something worth reading or do something worth writing about.” Be sure that your actions and your words communicate to people what you would most want them to know about you. Speak freely, listen well, and encourage others to do the same. Though your journey through life now takes you away from Penn, the part of that journey we shared leaves an indelible imprint on you and on those of us who stay behind to teach the incoming class. Again, I offer you congratulations and good luck.

Go Forth—Be Leaders

President Gutmann, distinguished faculty, members of the Class of 2007, parents, and guests: It is a real privilege to be asked to give the commencement speech at this illustrious and historic university. Were Benjamin Franklin with us today, I am confident that he would be impressed at how his vision for this school has become a dynamic reality.

Knowing that most of you are eager to get on with your lives, I intend to follow advice from Ben Franklin, who understood the importance of brevity when he said: “He that speaks much, is much mistaken.”

Franklin certainly did have a way with the English language. As you embark upon your future, it would be wise to remember the wisdom that Ben Franklin wrapped into his cleverly-worded sayings that charm us with their simplicity and humor.

Franklin’s quotes that I, (and perhaps some of you), may have followed too closely at times: “Beer is living proof that God loves us and wants us to be happy.” Instead, I refer to those witticisms that contain such a breadth of seriousness that, when they are properly embraced, they can guide your quest to become a better human being.

For example, as you conclude your college years, consider what Franklin meant when he said: “Some people die at 25 and aren’t buried until 75.” He meant, of course, that one’s life should be an evolutionary journey, and his certainly was. He never stopped learning. He continually challenged himself and the world around him. Indeed, had he and our other founding fathers remained satisfied with the status quo, there might not have been an American revolution.

Similarly, each of you should conscientiously challenge yourself and the world around you because your generation must address complex problems including, but not limited to, international terrorism, the proliferation of weapons of mass destruction, and global warming.

Without revolutionary approaches developed through fresh and critical thinking, you risk the consequences that inspired another Franklin saying: “When you’re finished changing, you’re finished.”

But, allow me to focus on a virtue that Franklin considered as critically important: leadership, and especially the leadership inspired by civic duty.

Ben Franklin was a true republican—with a small r. He emphasized that the American experiment would survive only if its people displayed the virtues required of civic duty and leadership in their daily lives.

So, leadership, is a worthy topic for this occasion today. This is not just because you are graduating from a top-flight university, but because, in a broader sense, this and every commencement symbolizes a first step in the transfer of leadership from one generation to the next.

The historian James MacGregor Burns defined leadership as “a commitment to values, ... and the perseverance to fight for those values.” I would say the same thing but a little differently. In my view, leadership is nothing more or less than “knowing what to do,” and then “doing it.” It is knowing what to do and then doing it when it is not the popular thing to do or when no one else may even know you are doing it. And leadership can be telling truth to power.

“Knowing what to do” and then “doing it.”

I want to give you three examples from history that illuminate the leadership challenges that can be posed by world events.

The first was the rise of Nazi Germany in the 1930s. In hindsight, we know that the world would have been spared endless misery if something had been done earlier, rather than later. But Western democracies were slow to respond. A few in the West admired Hitler, but most simply didn’t believe he was dangerous. Or if he was dangerous, they thought, he could be appeased. Others saw the danger, but few saw it more clearly than the great British leader, Winston Churchill. In a nutshell, he said this: “Don’t . . . appease . . . Hitler.” And, sadly, events proved him right.

When war came, Churchill said: “What is our aim? I can answer in one word. It is victory. Victory at all costs—victory in spite of all terror—victory, however long and hard the road might be, for without victory, there is no survival.”

While Churchill knew what to do, and he did it.

Immediately after World War II, we faced a second totalitarian challenge, this time by an emergent and ambitious Soviet Union.

By 1980, with memories of Vietnam and the Iranian hostage crisis fresh in our minds, it was not clear that the United States—or the West, generally—was willing to speak up for its interests and values, much less act forcefully to defend them. Maybe we had overestimated the danger of communism, some thought. Maybe we should back off.

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