

# **Curiosity, Education and the Still Unlovely Human Mind<sup>1</sup>**

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**The Van Sickle Endowed Lecture  
Clarkson University  
August 26, 2007**

Higher Education is the closest thing we have to an official rite of passage into adulthood. Class of 2011, you will experience and enjoy an abundance of adult-like freedoms in the next few years, but you will also be held responsible for managing your time, your work load, and your choices. You will be expected to become more aware of the world around you, and to face head-on the adult-sized truths that are thankfully ignored in one's youth.

And so right out of the gate, on the night before classes start, I welcome you to this university as young adults, and to an adult-sized reality. There are some uncomfortable truths that you must confront, accept, and learn to live with. And you are poorly equipped for the task at hand.

Class of 2011, you and your generation will be challenged to use your education as only few generations in history have been challenged.

I wish I could tell you that this last sentence was exaggerated for effect or simply to motivate you. When I was in the 10<sup>th</sup> grade my high school chemistry teacher, Mr. Rizzo, would frequently tell my classmates and me that we were the worst class he ever had. He finally admitted that he told every class, every year, that they were the worst class he ever had in order to motivate them; but that unlike those other classes, our class really was the worst.

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<sup>1</sup> The following are excerpts from the Van Sickle Endowed Convocation Address given at Clarkson University on August 26, 2007. Vitek speaks directly to the Class of 2011 and calls on them to recognize the challenges that their generation will face and to act with curiosity, courage, and fearlessness.

Like Mr. Rizzo I honestly believe that your generation really will face a challenge that has few analogs in human history. Many of you will be unwilling to accept it; most of you are still unprepared to confront it. A good university education will help you to meet this challenge, and you won't be alone. You will need to supply your own curiosity, resourcefulness, and courage in the face of what looks a wild ride ahead.

The greatest challenge for the Class of 2011, and your generation as a whole, is to learn to live in a world that is no longer well aligned with your beliefs about it. Or to put it another way, your central task is to dismantle some fundamental beliefs about yourselves and the world before these beliefs dismantle the world. You must, quite literally, begin to change your minds.

This is not as impossible as it sounds. You change our minds every day about the little things in life: fashion, food preferences, ring tones, and your favorite musical performers. And then there's Santa Claus and the Tooth Fairy. With the accumulation of too many unanswered questions—"What does the fairy want with all those teeth anyway, and how do reindeer fly?"—you change our minds, although not necessarily our hearts. More seriously, some of you may lose your religious faith or choose another one altogether, or change political parties. The human mind is not hard wired in every respect, and thankfully we live in a society where we are free to think for ourselves.

When I say that you will need to change your minds I am referring to what might be called the intellectual DNA of the modern mind, a deep seated set of core beliefs that are assumed, rarely questioned, and built into the educational system from kindergarten to the Ph.D. These beliefs are at work in the labs and classrooms of every modern university in the world, but they are also with you when you are at the mall or in your car or on your jet ski. They shape your expectations that high salaries and big houses will bring you happiness; and they cause you excitement about every new technological gadget.

Some of these beliefs have their earliest origins in ancient and well known stories about—of all things—theft: the theft of the knowledge of good and evil in the Garden of Eden by Eve and Adam, and the theft of fire by the Greek god Prometheus for the benefit of humankind. But it is a more recent historical period we call the Enlightenment that gave a modern voice to these beliefs. (And for you historians in the audience, I am including the

17<sup>th</sup> century in my use of this term). The Enlightenment claimed that human power and knowledge were no longer crimes against the gods, but rather the right of every human being.

You surely know some of their names: Galileo, Copernicus, Kepler, Descartes, John Locke, Thomas Hobbes, Francis Bacon, Voltaire, Isaac Newton, and Adam Smith. The Enlightenment produced revolutionary thinkers that freed human beings to embark on pursuits that had been forbidden or considered impossible: the control of nature; the creation of economies and technologies that went far beyond subsistence; individual freedom from oppressive governments, religions and family traditions; and a belief in human progress separate from the rest of life and largely unencumbered by moral and spiritual beliefs. Their names may seem dusty and distant, but their assumptions about the power of the human intellect to control and transform the world, and the seemingly infinite capacities of the earth to supply the goods necessary for human happiness, are your assumptions too. And these assumptions changed the world.

From 1750 to the present, and with continuous advances in science, technology, medicine and agriculture, the human population doubled three times, from 790 million to 6.6 billion, and counting. Our history books tell us about all of the personalities, discoveries and inventions that made possible this population growth and the advances of culture, but we probably know much less about the energy-rich carbon pools that fueled this population surge, and with it everything we associate with the modern world. I mention them because energy is at the very center of all advanced civilizations, including our own. Long before the Enlightenment the soil of the Fertile Crescent was the first carbon pool to be tapped twelve thousand years ago, giving birth to agriculture and the first increases in human population. The second pool—forest carbon—furthered human dominance of the world and made the bronze and iron ages possible. And wood served as the preeminent energy source in the United States during its first one hundred and fifty years.

But it was the third carbon pool—coal—that fired the industrial revolution and that remains a critical source of energy. In 2004 the world used over 6 billion tons of coal. The United States used a billion of those tons in 2004 and is expected to need 1.5 billion tons in 2025, most of it going to the production of electricity. Oil and natural gas are the most recent carbon pools, discovered first in large quantities in Pennsylvania in 1859 and later

worldwide, and that together fuel the global economy today. Oil is currently consumed at the rate of 86 million barrels/day around the world, and the demand is expected to grow to 113 million barrels/day by 2020. The world used 100 trillion cubic feet of natural gas in 2004, and is expected to need 150 trillion cubic feet by 2020. And in what seems like an ironic twist of fate, the largest known quantities of oil and natural gas are underneath the now mostly exhausted soils and forests of the Middle East's Fertile Crescent.

Oil and natural gas are not just in our cars, planes and home furnaces. They are used to make insecticides, tires, trash bags, shampoo, cameras, food preservatives, anesthetics, upholstery, eyeglasses, credit cards, fertilizers, crayons, insect repellent, toilet seats, golf balls, antihistamines, guitar strings, toothpaste, tennis rackets, carpeting, artificial turf, heart valves, aspirin, and shaving cream. Our lives would be very difficult without oil and natural gas. Were we to also take away the coal, half of America's electricity would go with it.

Oil, natural gas, and coal are the primary feedstocks of our modern civilization just as the ideas forged in the Enlightenment are the primary feedstocks of our modern mind. Each feeds the other. And for those of us who have been alive these last fifty years in industrialized societies, particularly in America, it has been a wonderful ride, an amazing and blazing run on the carbon bank.

Paul MacCready, the visionary engineer and inventor of the first practical flying machine powered by a human being, has made a calculation that captures the enormity of our success. He estimates that ten thousand years ago human beings, plus their domestic animals, accounted for less than a tenth of 1 percent by weight of all vertebrate life on earth and in the air. Today, that percentage, including livestock and pets, is in the neighborhood of 98% of the weight of all vertebrate life on earth.<sup>2</sup>

We should probably excuse the Enlightenment revolutionaries for mistaking nature as infinite and infinitely malleable when humans were a scarce, weak species pursuing their projects in the small clearings that culture made on our very sizable planet. But standing on their shoulders we find ourselves in a

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<sup>2</sup> From Daniel C. Dennett, *Breaking the Spell*.

very different time and place. The Earth is not nearly as big and as impervious to harm as our predecessors thought, nor possessed of bottomless fuel tanks.

As the data continue to come in it appears that the processes driving our exponential growth may be at their peaks. And as with most exponential growth in biological systems—and it is a very large biological system—the Earth—that we are talking about here—what goes up exponentially usually comes down exponentially too. Your parents' generation rode this exponential wave to the top and it looks like your generation will be the first to be riding down the other side of the peak, the first to usher in what Wes Jackson calls "The Age of the Rapid Depletion."

Here are some terrible and terrifying facts that give The Age of the Rapid Depletion its name:

- In January of this year The Bulletin of the Atomic Scientists moved its doomsday clock two minutes closer to midnight, "reflecting global failures to solve the problems posed by nuclear weapons and the climate crisis."
- Eight nations possess nuclear weapons, and two more are known to be working to acquire them.
- Current data indicate atmospheric Carbon Dioxide, a greenhouse gas, is at a 650,000 year high.
- The latest report of the Intergovernmental Panel on Climate Change states that "there is a 90% chance humans are responsible for climate change," mostly due to the burning of fossil fuels.
- The world's leading petroleum geologists estimate that in less than a century the modern world has burned its way through half of the global supply of oil, and that the other half may be gone in as few as thirty years. Fifty four percent of the oil already consumed—a half trillion barrels—was consumed in the last 22 years alone. The numbers and predictions for natural gas are similar.

- The current rate of species extinction is being compared to the five known mass extinction waves. This sixth wave is caused by humans, not asteroids, and according to the Millennium Ecosystem Assessment Report, agriculture is the largest threat to biodiversity.
- Speaking of agriculture, it's not just for food anymore. Large numbers of Mexican farmers and workers recently protested the high cost of tortillas, a food staple, due to the increased exports of Mexican corn to America for the production of ethanol, an alternative to gasoline.
- Soil destruction now claims 24 million acres a year world-wide.
- One billion people lack access to fresh water.
- Two of the world's most populous nations—China and India—are on the path to becoming two of the world's largest economies. Their economic good fortune accelerates the rate of depletion worldwide.
- Human population growth continues to follow an exponential curve.
- It is estimated that there are currently 27 million slaves in the world, more than at any other time in human history. In 1850 a slave cost 40,000 of today's dollars. A slave can be purchased today for a mere \$30. (Bales, 1999).<sup>3</sup>

That's a lot of facts and figures to process, and I would apologize for overwhelming you with them were it not my intention to overwhelm you with them. You, we, all of us, need to feel the enormity of the challenges that we face and to see the connections between them. In a world overcrowded with desperate people, the slave market, tragically, grows. Fresh water is scarce because of the demands of industrial agriculture to supply food to a global population that grows by 85 million people a year. The high demand for ethanol as an alternative to fossil fuels reaches further into the well: it takes three gallons of water to produce one gallon of ethanol. And a world made less stable by the high demand for energy becomes even

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<sup>3</sup> <http://dawn-drupal.science.oregonstate.edu/facts>

more dangerous with nuclear weaponry. Meanwhile, hurricanes increase in intensity, and summer temperatures soar around the world—it reached 113 degrees in Athens, Greece this summer.

OK, you say, but the Enlightenment mind can solve these problems with better technology and the march of progress. I am not so sure. What we commonly call “progress” has produced some of the very problems we expect progress to eradicate. Advances in agriculture and medicine have led to the exponential growth of the human population, and that has put increased demands on topsoil and fresh water. Technology has made more of the world’s fossil fuels accessible, leading to increased consumption and an increase in atmospheric carbon.

Optimists talk about efficiency, but paradoxically efficiency leads to higher consumption. It’s called Jevons Paradox, named after the man who demonstrated that as 19<sup>th</sup> century Great Britain became more efficient in its use of coal, it actually consumed more of it. Even if every car in the world was a hybrid, and every light bulb a compact fluorescent, the continuing growth demands for cars and light bulbs worldwide would easily dwarf the savings. New technologies will help replace old technologies, but they will create unforeseen problems of their own. And they will take time to develop. The late Cornell physicist and Nobel Laureate Hans Bethe used to point out that no form of energy – from the draft horse to coal to petroleum to nuclear power – ever became a fuel for commonplace technology in fewer than fifty years. Sorry, there are no quick fixes on the energy front.

Class of 2011, you will have to change your minds because nearly everything you believe about yourselves and the many talents that you possess are likely to further increase human population and consumption, to make life worse for millions—perhaps billions—of people worldwide, to increase species extinction, to extract from the earth more energy rich carbon than the earth can ever replace in a human timeframe, and to release more carbon into an atmosphere already too full of it. Your Enlightenment mind and its technological fundamentalism have become dangerous disabilities in the 21<sup>st</sup> Century. You need to help usher in a new Enlightenment that values and protects human freedom and dignity while rejecting the beliefs that we can master the earth and treat it merely as our personal supermarket, playground, laboratory and dumpster.

Hard truths, once confronted, can change our lives for the better, especially when ignorance is no longer capable of providing bliss. And overwhelming challenges, when faced with strength and creativity, can be overcome.

The first steps toward changing your minds require you to upset your routines, to become curious again, and to imagine alternatives. Higher education is a good place to begin this journey.

- Find people on this campus who don't agree with your core views and talk to them. Listen too. If you don't believe a fact or figure, find out for yourselves. Expand your circle of friends, organize and attend campus debates, and get involved in causes you care about.
- Read a respected national newspaper (there are plenty to choose from; look for the ones that win Pulitzer Prizes); and try to get your news from at least two sources, and ideally one source from outside the United States. The press—what is often called the fourth branch of American government—too often serves its advertisers and owners and their political agenda, rather than the American people, and so we don't hear enough about what's really going on in the world.
- Re-engage your curiosity. Sadly too much of your formal education has been devoted to tests and the uninspired routines of classroom learning. One of the saddest things I ever heard was my son Ian telling me he no longer liked school because all he ever did was take tests. And he was in the 4<sup>th</sup> grade. You have permission to re-engage your intellectual curiosity at college, to ask difficult questions, to challenge your professors, and to demand an education that prepares you for the century we are in rather than the one we just left. In fact, curiosity is a requirement if you are to get your money's worth.
- Take advantage of your education, yes, but be wary of it too. It was historian Edith Hamilton who said that “there has never been a generation better educated than the one that ushered in the end of Athens.” Philosopher and economist Adam Smith said that universities were often “sanctuaries in which exploded systems and obsolete prejudices find protection after they have been hunted out of every other corner of the world.” And between the *original* discovery that our earth moves around the sun, and not the other way around, by the Greek astronomer Aristarchus—and its *rediscovery* by



Copernicus, there were 1700 years of active resistance to this truth by some of the world's greatest minds of antiquity—Plato and Aristotle among them—and by the learned professors of medieval Europe's most prestigious universities. I'd like to say that higher education has all the right answers. Sadly, it often has many of the wrong answers, and the power to resist the right ones.

- Learn something about Peak Oil, Ecological Footprints, Industrial Ecology, Embodied Energy, Biodiversity, the Precautionary Principle, Life Cycle Analysis, Jevons Paradox, Biomimicry, Carbon Neutrality, Micro Lending, The Genuine Progress Indicator, and Natural Systems Agriculture. These and other new terms and concepts are already making a difference, and they will help define what it means to be an educated person in the 21<sup>st</sup> century.
- Master the fundamentals. What we now call majors and minors are more accurately called “disciplines,” and for good reasons. You'll grumble about all of the foundation courses you have to take, but those foundations are crucial to your success. Be especially attentive to statistical analysis, exponential growth, and the fundamental laws and principles of nature, particularly those found in the study of the earth and life sciences. The principles of geology, biology, and ecology need to be part of every student's higher education in the 21<sup>st</sup> century, particularly engineering students. I'm going to say that again. The principles of geology, biology, and ecology need to be part of every student's higher education in the 21<sup>st</sup> century, particularly engineering students. Find a way to squeeze them into your education. Better yet, demand that they become a required component of your education.
- It is the right of every younger generation to reject their elders' advice and views about the world. And your generation has done that better than most. With i-pods feeding you only the music you select, computer and internet games that seem more real than reality itself, and your instant access to friends and family by cell phone—the average American teenager now sends and receives nearly 40,000 text message a year—you have found it easy to drown out what you don't want to hear. Please, let in more of the world, even the parts you don't like; especially the parts you don't like.

- And if you want to get started right away, you might give some serious thought to solving these problems: 1) reduce human population by eighty percent from its current level without famine, war, viruses or the loss of human dignity; 2) eliminate the automobile as a form of personal transportation; 3) create political and social systems that run on a solar economy; 4) revise the scientific method so that it more accurately balances the discovery of new knowledge with moral considerations and precaution; 5) devise viable models of happiness and success that do not require economic growth and increased consumption; and 6) make the virtues of humility, cooperation, generosity, gratitude, kindness and thrift cool again, or hip, or bad, or the bomb, or whatever word or phrase you use to describe something really good and worth having.

When you change your mind powerful things begin to happen. The inconceivable becomes possible, and the possible becomes commonplace.

Wes Jackson changed his mind about how we grow food. For the last thirty years he and his colleagues at the Land Institute have been working to transform the major food crops from annual monocultures into perennial polycultures; in other words, to turn the average corn field into an abundant, complex and resilient prairie of food. Their efforts are featured in this month's issue of *Scientific American* and are described in this way: "The challenge is monumental, but if these plant scientists succeed, their achievement would rival humanity's original domestication of food crops over the past 10 millennia, and be just as revolutionary."

Vandana Shiva changed her mind. Trained as a physicist, Shiva is described as "one of the world's most prominent radical scientists." She is the founder of a movement for biodiversity conservation and farmers' rights in India, and her studies have validated the ecological value of traditional farming and have been instrumental in fighting destructive development projects in India.

David Orr changed his mind. Not content to simply teach environmental studies, Orr single handedly raised \$13 million dollars and brought together some of the world's most creative architects. Together they built the Adam Joseph Lewis Center for Environmental Studies at Oberlin College, one of the most sustainable educational buildings in the world. On most days it generates as much or more energy that it consumes.

Engineer and businessman Ray Anderson changed his mind about how to make carpet. As founder and CEO of Interface Carpet, a billion dollar company, Anderson decided fifteen years ago to change radically how his company would do business and to make it “the first company that, by its deeds, shows the entire industrial world what sustainability is in all its dimensions: people, process, product, place and profits.”<sup>4</sup>

There are countless more examples—thousands actually—of individuals and organizations that have decided to change their minds and directions.

This is your century Class of 2011 and, ready or not, you will be going through the greatest and most important transition in human history. I hope you consider it an exciting time, filled with opportunities to think big thoughts and to imagine wonderful alternatives. Imagine feeling at home on an earth that is very much alive, interconnected, filled with morally valuable species, and limited in terms of how much it can provide; where our own ignorance about it will always exceed our knowledge; and where our curiosity promotes understanding—not subjugation—of the earth’s complexity, beauty and resiliency.

Consider yourselves revolutionaries and imagine your names in future history books.

Humans are creatures of evolution and the mind is a work in progress. Over the long haul, and working and living well with others, we can all contribute to building “receptivity into the still unlovely human mind,”<sup>5</sup> beginning with our own.

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<sup>4</sup> <http://www.interfaceinc.com/who/founder.html>

<sup>5</sup> Aldo Leopold’s words.