Essays and Commentaries II

James D. Wells

Ann Arbor, Michigan, USA

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The “vagrant and unfocused” career of Leonardo da Vinci

“Of the many mysteries surrounding Leonardo da Vinci none is more remarkable than the disproportion between the quantity of his finished works and the grandeur of his reputation. Our awe of Leonardo is as much for what he was as for what he did, as much for his reach as for his grasp. His career was vagrant and unfocused – in fact, he never had a career.”

Daniel Boorstin. The Creators. New York: Vintage Books, 1992.

Comment: Boorstin’s book is an absolute monument to erudition and a pleasure to read. His writing style is elegant and his opinions are strong and unambiguous. He devotes a full chapter (chapter 44) to Leonardo da Vinci, who was born in 1452 as the “illegitimate son of a prosperous Florentine notary, … [but] raised in his father’s house as if he had been legitimate.” His mother was likely a peasant.

Da Vinci was one of those guys who did everything. He painted, he sculptured, he studied mathematics, he dissected corpses, he engineered things, and he taught himself Latin at age 42, among many other activities. However, he wasn’t the best at anything he did, but rather the best at doing so many things creatively. 3500 pages of his notebooks survive that he kept of his ongoing ideas and projects, most of which he never started, much less finished. It is thought that that might be only a quarter of all he wrote. He wrote most pages backwards so that they could only be read easily in a mirror. Almost none of his writings contain anything personal. It’s all about ideas and projects. He must have struck quite the eccentric figure, and must have overwhelmed everyone in earshot with his creative and fertile mind.

There is the Mona Lisa, and there is the Last Supper, two extraordinary paintings by da Vinci, and there are his inventive drawings, and his scintillating engineering ideas. But according to Boorstin his reputation was achieved by “what he was” and “for his reach” rather than what he actually accomplished. Many people accomplished much more than him in any particular area of his interest. And so, we are left to ask, can it be that the power of his creative personality was so dominant, and his image so luminous, that it has sustained his reputation for 600 years? Apparently so.

(2013)

Pascal's Conformal Commitment

Many of us know Blaise Pascal (1623-1662) as a brilliant mathematician and physicist. However, at the age of 30 he had a profound religious experience and more or less gave up all of this work, and turned to religion. The first result of that conversion was his book *Provincial Letters*, published in 1656 under a pseudonym, which attacked Jesuits for their moral laxity and for their casuistry condemnations of Jansenist theologian Antoine Arnauld.

Being a systematic thinker, Pascal set out to write a new book, *Defense of the Christian Religion*, but died in 1662 at the age of 39 before he could write it. However, the scraps of notes that he compiled for the book were posthumously published as *Pensées* ("thoughts"). It is in *Pensées* that Pascal articulates what has become to be known as "Pascal's Wager", which states that it is better to follow the Christian religion, which promises all for eternity, than it is to not, which promises nothing good for eternity.

Despite Pascal's abandonment of mathematics and physics in favor of his new pious pursuits, his mind could not help but be infected by his background. Even in the midst of intense religious reflections, questions of science rise up in him and influence his religious worldview.

One of the most intriguing examples of this I find is in the section of *Pensées* titled, "Transition from Knowledge of Man to Knowledge of God." This section really is Pascal wrestling with the idea of scales. Man is tiny, and God is infinite. But what makes something small? Why is one scale more "attractive" than another scale when it comes to the size of things.

Pascal first articulates his interest in the question in Pensée 194 : "Why have limits been set upon my knowledge, my height, my life, making it a hundred rather than a thousand years? For what reason did nature make it so, and choose this rather than that mean from the whole of infinity, when there is no more reason to choose one rather than another, as none is more attractive than another?"

Pascal struggles with this question, and he must have been convinced that there is no good reason to prefer one scale over another. It is inconceivable to him that nature should be forced to make a choice. But what is one to do when we see that man is only a few feet tall, no more and no less?

Pascal builds up the question in Pensée 199 : "Let man, returning to himself, consider what he is in comparison with what exists; let him regard himself as lost, and from this little dungeon, in which he finds himself lodged, I mean the universe, let him learn to take the earth, its realms, its cities, its houses and himself at their proper value. What is a man in the infinite?"

The scales of the infinitely large and the infinitesimally small are equal to Pascal. There can be nothing special. And so he exhorts the reader to come with him to the infinitesimally small to see that it is not unique : “I want to show him a new abyss. I want to depict to him not only the visible universe, but all the conceivable immensity of nature enclosed in this miniature atom. Let him see there an infinity of universes, each with its firmament, its planets, its earth, in the same proportions as in the visible world, and on that earth animals, and finally mites, in which he will find again the same results as in the first” (Pensée 199).

Pascal has now successfully put forward a worldview that does not make our scale of existence unique or special. All scales in nature are equally valid and equally rich. This conformal symmetry, or more technically a fractal self-similar symmetry, was so enticing to Pascal that he was willing to speculate the existence of an infinite number of self-similar worlds at all scales in defense of the principle. This is a true mathematician and theoretical physicist at heart.

Now that he has this structure in place he is forced to ask himself what is the connection between the very smallest and the very largest scales. Can there be something that ties them together to make a clean contiguous structure. If you remember that he has become intensely religious his line of reasoning and answer will not surprise you : “We naturally believe we are more capable of reaching the centre of things than of embracing their circumference, and the visible extent of the world is visibly greater than we. But since we in our turn are greater than small things, we think we are more capable of mastering them, and yet it takes no less capacity to reach nothingness than the whole. In either case it takes an infinite capacity, and it seems to me that anyone who had understood the ultimate principles of things might also succeed in knowing infinity. One depends on the other, and one leads to the other. These extremes touch and join by going in opposite directions, and they meet in God and God alone” (Pensée 199).

And there he tells us how it all fits together. The infinitely small and the infinitely large appear to diverge in opposite directions in this conformal view of nature, but ultimately they meet in God, who is the master over all domains, and all scales, who is the alpha and the omega. Q.E.D.

Reference

Pascal, Blaise (1995). *Pensées*. London: Penguin Books.

(2011)

1936, the year of the first Fields Medalist, and the year MIT kicked him out

Joseph Plateau (1801-1883) was studying bubbles in a special liquid that he invented, glyceric liquid, when he suggested that there is an area minimizing surface to a boundary that can be seen experimentally by soap films stretched across wire boundaries. The problem of establishing this in a rigorous mathematical way became known as "Plateau's Problem", even though Lagrange had formulated the mathematical question in 1760.

The first to solve Plateau's Problem rigorously and generally was the brilliant and creative mathematician Jesse Douglas (1897-1965). He reported his discovery in his seminal 1931 paper on the subject (Douglas 1931). His techniques are still being used in research today in a wide variety of applications (see, e.g., Kruczenski 2014), and is one of the cornerstones of the calculus of variation.

The mathematics of this problem is fascinating, and I recommend Nitsche (1989) for a technical pedagogical text. However, I would like to draw attention to another aspect of this story, which is covered in Rassias (1992). It is a personal story regarding Douglas.

It is perhaps not well known that Douglas was awarded the Fields Medal of Mathematics in its inaugural year of 1936. The Fields Medal is considered by some to be the "Nobel Prize of Mathematics", except there is one very important difference. The recipient has to be below the age of 40 to receive a Fields Medal – in the prime of the mathematician's career, or at least close to prime -- whereas the Nobel Prize is often a retirement gift for work done decades ago.

This is just one indication of the extraordinary talent that Douglas was. In today's world, extraordinary talent can protect you from the consequences of bad behavior, whether it be irresponsibility in teaching or service assignments or otherwise. Well, back then, even at MIT, where Douglas spent the early years of his career, they wouldn't tolerate irresponsibility no matter how talented he was. Even knowing that he was a world-class mathematician – and there weren't many of those in the U.S. in the middle 1930's – MIT kicked him out. It does not seem that he was malicious or mean. He was just irresponsible and they forced him out.

Here's a relevant quote by Dirk Struik, professor mathematics at MIT, on Douglas's situation:

"Jesse Douglas became a member of the mathematics department at MIT in 1930. He was, at 33 years of age, already a well-known scientist who had written an interesting doctor's dissertation in differential geometry … and, above all, had already been publishing on his solution of the problem of Plateau, subtle and highly original work for which he would receive the Fields Medal…. His health prevented

him not unfrequently [sic] to come to his class on the regular schedule, so that Henry Philips, the head of our department, insisting on conscientious teaching, had to let him go, to my and others' regret. This was in 1936, the year he received the Fields Medal." (Rassias 1992, pp. 41-42)

The question becomes, would your university leaders today solve the "Douglas Problem" like MIT did in 1936, and force him out? Likely not. In today's academic world we have more patience for professors of much less distinction than that. I suspect most today would tolerate sub-par teaching, in the naïve definition of teaching, to hold on to a professor with that research power. For graduate education and the attainment of new knowledge that's probably the right decision. Good teachers in the normal sense of the word are key to education and extremely valuable, but they can be found and recruited everywhere. A Fields Medalist, on the other hand, is somehow uniquely capable of inspiring students and other faculty to greater research heights. That is rare. Let him teach a seminar to graduate students, where he would have been maximally appreciated, but don't lose him. MIT made a mistake, and we all suffer from not knowing what Douglas and his would-be MIT students could have discovered in mathematics while he instead languished in a stultifying environment after being let go.

References

Douglas, J. "Solution to the Problem of Plateau." *Trans. Amer. Math. Soc*. vol. 33, pp. 263-321 (1931).

Kruczenski, M. "Wilson loops and minimal area surfaces in hyperbolic space." *JHEP* 11, 064 (2014). arXiv:1406.4945.

Nitsche, J.C.C. *Lectures on Minimal Survaces, Volume 1*. Cambridge University Press, 1989.

Rassias, T.M. (ed.). *The Problem of Plateau*. World Scientific, 1992.

(2014)

High-flying broad physics instruction not very useful

Max Planck, the originator of quantum theory and one of the greatest physicists of the 20th century, was also a philosopher and essayist. One of Planck's more interesting essays was "Scientific Ideas: Their Origin and Effects" (Planck 1938). The purpose of that essay was to describe "how a scientific idea arises and what are its characteristics" (p.88). The essay develops his thesis that ideas are based on concrete experiences that are compared and then links are forged between the old and new and the "idea becomes fruitful … if the interconnection thus established can be applied more generally to a series of cognate facts" (p.89). The essay then argues that his theory of scientific ideas matches historical examples, such as Newton's theory of mechanics and Clausius's thermodynamics.

However, in my view the essay's value is less connected to his main goal of developing the theory of ideas described above, which is not terribly unique or helpful in my view. Rather, more interesting is his various digressions, from the perspective of a world-class physicist, that are connected to the development of ideas. One of his most impassioned digressions is on education. Developing great ideas requires individuals who can do it, and that requires that they be educated properly.

Max Planck has strong opinions about how to educate students properly in school that would yield productive scientists. This is what he had to say:

"What is learned at school is not as important as how it is learned. A single mathematical proposition which is really understood by a scholar is of greater value than ten formulae which he has learned by heart and even knows how to apply, without, however, having grasped their real meaning. The function of a school is not so much to teach a business-like routine as to inculcate logical and methodical thought. … Hence the first requisite, if good work is to be done, is a thorough elementary training; and here it is not so much the quantity of facts learned as the manner of treatment that matters." (Planck 1936, p.98)

I can't agree more with Planck. We have all seen the student who is focused on memorizing equations, knowing how to do many key simple examples mechanically, but who has no strong critical approach to his or her knowledge. A deep understanding is not there.

In addition, Planck is saying something beyond criticizing the superficial learning approach of some students. He is also criticizing teaching that emphasizes breadth over depth. From Summer Schools to Master's programs to individual courses, there is a strong tendency for faculty to fly high and cover too much material in the alotted time rather than delve into less material more deeply and proceed thoroughly. The temptation is very strong to do this for several reasons. First, when you cover material very deeply, there will always be a group of students who do not catch the

vision of how important it is to really thoroughly crush the material, leaving no stone unturned, leaving no assumption unexposed, and leaving no calculation ambiguous. They exude impatience at what they see as pedantry. This is difficult for students, not to mention faculty, who may feel that they are boring their students. Or, as is often the case, the faculty may also not have the fortitude, desire or ability to really get to the very bottom of the material themselves and would rather fly higher and imply that they would tell more if they had the time.

Another drawback of covering things deeply is that it means you must sacrifice other topics. If you can cover ten topics without too much depth or four topics in great depth, students and faculty both find it more satisfying to hear about all those ten things than beat four things into the ground. But Planck says no, you need to beat things into the ground to produce real scientists. Only then will they have the example and training to get to the bottom of their own research when the time comes. They must be led to develop the ability to pursue ideas to their very core, thoroughly understand them, and construct new ideas from the depth of understanding. Only then does a scientist have a chance to have and develop a profound insight and make a breakthrough.

Reference

Planck, Max (1938). *The Philosophy of Physics*. New York: W.W. Norton & Co. (Norton Library Reprint ed., 1963.)

(2016)

Reading seminars in Japanese education

It is well known that the Japanese university system produces some of the most impressive theoretical physicists and mathematicians in the world. When encountering success it is interesting to note how they go about their business. There are many similarities between the Japanese educational system and the American educational system, but there are at least two very substantive differences noticed while on a recent visit to Nagoya University.

First, the Japanese physics student learns much more physics and mathematics as an undergraduate than the typical American university student. While Americans are half-filling their schedules with general education course requirements, such as History of Jazz and The 19th Century Epistolary Novel, Japanese students are learning more physics and math. There are pluses and minuses to the American system, but it must be recognized that American students are often far behind just about everyone in the world in their major studies upon undergraduate graduation.

The second difference is the prevalence of "reading seminars" in Japanese university education. These are offered for Japanese advanced undergraduate students and graduate students.

In any given semester a student is formally a member of one reading seminar supervised by a faculty member, and the student is usually also a member of extra informally organized seminars with other students and maybe even faculty. Each seminar typically meets once a week for about 3.5 hours (1-4:30pm appears to be popular). There is a text that everyone is supposed to have read thoroughly and understood as best as possible before meeting. It may be a textbook or a research paper/review.

The seminar is conducted by asking a student to go to the board and lead the group in covering the material. In some reading seminars the instructor will randomly select a student — making all students feel the pressure to read and study well before they come to every class. In other reading seminars a student or several students are assigned beforehand to be lead presenters. They work through the text, asking many questions, and making sure everyone knows the material extremely well. The reading seminars are formed with students at roughly similar levels of background and interests. Wildly disparate background preparation and interests lead to less effective reading seminars.

It is my understanding that these reading seminars are considered by students and faculty to be where some of the most effective learning takes place at the university. The obvious benefits of these groups are partly what causes the students to organize themselves into additional reading seminars informally to learn material of most interest to them. In addition, the university recognizes the importance of these seminars and gives faculty teaching credit for supervising one during the term.

It looks like a fun and effective approach to teaching and learning. Many places in the U.S. have informal journal clubs that operate somewhat similarly, but few if any places employ such systematic and intensive use of this approach to learning as is done in Japan. From the successes encountered in Japan, perhaps reading seminars would be good to implement in a more extensive way at American universities.

(2016)

Chris Rock on writing

Chris Rock's paraphrase of advice Louis CK gave him on writing:
"You gotta write this by yourself.... You gotta get in a room, and you have to feel hurt, you have to feel lonely, you have to feel the pain, the blood sweat and tears it takes to write by yourself, to be in a hole and stare at a piece of paper and have no one to help you get out of this thing but you. You always write with people and you end up with a watered down version of you. You have to write by yourself...."

Chris Rock describes experience of writing alone:
"When you write with other people you get a consensus.... When you are in that room by yourself, man, something emotional happens, something spiritual comes out of you, when you're in that room by yourself, you know, and you're living in your head, and your secret thoughts, and you're not trying to get approval from anybody when you're in there by yourself."

From Charlie Rose interview of Chris Rock, aired 12 December 2014 (PBS).
This interview was carried out during Rock's press tour of the film "Top Five".
http://www.pbs.org/video/2365384481/

Comment: These quotes are very relevant to science writing as well. The first quote – advice from Louis CK – is advice every physics professor tells physics students about homework. "You have to feel the pain, the blood sweat and tears it takes to write [problem solve] by yourself." Exactly!

And the second quote is equally applicable. A report with multiple authors can be better than a single author paper in some ways. For example, obvious things are not usually missed with many authors. However, richness, depth of clarity, courage, impact and beautiful style – that comes when an author writes alone.

(2015)

No success without total devotion

“Still, few people, even those hugely gifted, are capable of the application and focus that Mozart displayed throughout his short life. As Mozart himself wrote to a friend, 'People err who think my art comes easily to me. I assure you, dear freiend, nobody has devoted so much time and thought to composition as I. There is not a famous master whose music I have not industriously studied through many times.' Mozart's focus was fierce.”

“Without the time and effort invested in getting ready to create, you can be hit by the thunderbolt and it'll just leave you stunned.”

“I don't want them merely involved. I'm looking for insane commitment. I'm no less strict with myself. I'm always taking temperature readings of my commitment to a project and pushing myself to be more committed than anyone else.”

Comment: If you want to be creative, you can’t just be “gifted”. You have to have total dedication and work extraordinarily hard. In my experience it is more rare to find somebody who is willing and capable of extreme devotion to their calling than it is to find a “genius” or a somebody extremely talented. Talent alone does not go very far in this world. It is merely a necessary condition, but not sufficient.

From Twyla Tharp. *The Creative Habit*, 2003 (2006 Simon & Schuster paperback).

(2009)

What endures from school

"In just two years of intensive German study, I achieved a high level of linguistic competence and confidence. There was nothing mysterious about Joe's teaching methods. We learned by spending hours every day on grammar, vocabulary, and style, in the classroom and at home. There were daily tests of memory, reasoning, and comprehension. Mistakes were ruthlessly punished. … There was no praise, no warm fuzzy familiarity or softening of the critical blow…. It seems to me significant that in all my unpleasant memories of school, the one unambiguous positive is the two years I spent having the German language driven mercilessly into me. I don't think I am a masochist. If I recall 'Joe' Craddock with such affection and appreciation, it is not just because he put the fear of God in me or had me parsing German sentences at 1 AM lest I be dismissed the next day as 'absolute rubbish!' It's because he was the best teacher I ever had; and being well taught is the only thing worth remembering from school." (p.87-89)

From Tony Judt. *Memory Chalet*. Penguin Press 2010.

Comment: When you are young and you just want to play sports or spend time with your friends, teachers like Joe Craddock get in the way. However, when you are older you will find that you will feel you have been cheated by "cool" teachers who just messed around and gave you A's. You didn't learn, and the trajectory of professional and education success in your life is altered and lowered. As Tony Judt says, slightly exaggerated, "being well taught is the only thing worth remembering from school."

(2010)

Fundamental physics is not yet simple enough

Murray Gell-Mann, the physicist credited for first understanding quarks in particle physics, tell us that our current theory of fundamental physics is not yet simple enough:

"Those of us who helped put together the standard model are naturally rather proud of it, since it brought a good deal of simplicity out of a bewildering variety of phenomena. ... Second, the model is not yet simple enough; it contains more than sixty kinds of elementary particles and a number of interactions among them, but no explanation for all that variety."

M. Gell-Mann. *The Quark and the Jaguar*. Little, Brown and Co., 1994.

Comment: I completely agree. There are additional concepts of unification and additional unifying principles that we still have not hit upon that will arrange the mess of the Standard Model of fundamental particle physics into a more compact theoretical structure. It has always been that way in natural law, and no reason to believe that discovering additional unifying organization principles should cease.

(2012)

The Process of creativity

In chapter 17 of Gell-Mann's *The Quark and the Jaguar*, the physicist Gell-Mann explains the process of creativity:

Stages leading to creative idea (stages expressed by Hermann von Helmholtz)

- Saturation: filling our minds with everything about the problem
- Incubation: letting it churn subconsciously
- Illumination: idea comes at some random time or circumstance

Incubation can be aided by brainstorming, and applying random thoughts or random learning to the idea.

Characteristics of those who are creative and escape to deeper basins of thought: "Those characteristics include a dedication to the task, an awareness of being trapped in an unsuitable basin, a degree of comfort with teetering on the edge between basins, and a capacity for formulating as well as solving problems."

From M. Gell-Mann. *The Quark and the Jaguar*. Little, Brown and Co., 1994.

Comment: M. Gell-Mann's first characteristic of creative people is "dedication to the task", which I agree with. The rest is secondary and is merely descriptive of what generally inevitably happens when dedication is present. When strong desire is there, and total dedication applies, all this stuff about basins and teetering on the edge between them, etc., just happens.

(2012)

IQ and conscientiousness are keys to success

"It [IQ] is the most well-validated concept in the social sciences, bar none. It is an excellent predictor of academic performance, creativity, ability to abstract, processing speed, learning ability and general life success.

There are other traits that are important to general success, including conscientiousness, which is an excellent predictor of grades, managerial and administrative ability, and life outcomes, on the more conservative side.

It should also be noted that IQ is five or more times as powerful a predictor as even good personality trait predictors such as conscientiousness. The true relationship between grades, for example, and IQ might be as high as r = .50 or even .60 (accounting for 25-36% of the variance in grades). Conscientiousness, however, probably tops out at around r = .30, and is more typically reported as r = .25 (say, 5 to 9% of the variance in grades). There is nothing that will provide you with a bigger advantage in life than a high IQ. Nothing. To repeat it: NOTHING."

J.B. Peterson, in response to question "What is more beneficial in life; a high EQ or IQ?" https://www.quora.com/What-is-more-beneficial-in-life-a-high-EQ-or-IQ (accessed July 3, 2016)

Comment: Never heard it stated so strongly before by a revered social scientist. You can't control IQ very much but you can control conscientiousness (probably). So, get crackin'.

(2016)

Genius is infinite capacity for taking pains

"Thomas Carlyle in an after-dinner speech stated that genius was an infinite capacity for taking pains."

Somerset Maugham. *Cakes and Ale*. Vintage Books, 2000.

Comment: All extraordinary achievement comes from this. The great painters, the great athletes, the great physicists, the great novelists, the great dancers, the great mathematicians all have one thing in common : they have “infinite capacity for taking pains.”

(2014)

Learn from your elders but follow your convictions

"From the earliest times the old have rubbed it into the young that they are wiser than they, and before the young have discovered what nonsense this was they were old too, and it profited them to carry on the imposture."

Somerset Maugham. *Cakes and Ale*. Vintage Books, 2000.

Comment: This is tricky. You must simultaneously learn all the wisdom of the old, while at the same time have the courage, wisdom and confidence to go a different direction when warranted. Striking out on your own in directions that make no sense and will lead to your destruction is a risk. However, doing something great requires that kind of abandon. What makes young people revolutionize physics and mathematics more often than older people is that they are usually not experienced enough to know that their ideas cannot pan out. And then it does.

(2014)

Live mice versus dead lions

From a conversation in Somerset Maugham's novel *Cakes and Ale* from 1930:

"'You don't know America as well as I do,' he said. 'They always prefer a live mouse to a dead lion. That's one of the reasons why I like America.'"

Comment: In my years in Europe and my years in the U.S., I can attest that this is still true. I would not necessarily say that one is better than another. In Europe, the biggest grants to scientists often go to very senior professors, which has been ridiculed by many younger scientists in Europe who sometimes do not have adequate resources to pursue their research. On the other hand, in America the biggest grants often go to the very new assistant professors, while the older and more accomplished professors languish with reduced resources. This has been criticized heavily at times by the older professors. Perhaps some compromise and balance between the two extremes makes more sense.

(2015)

The real advantage of truth

"It is a piece of idle sentimentality that truth, merely as truth, has any inherent power denied to error, of prevailing against the dungeon and the stake. Men are not more zealous for truth than they often are for error, and a sufficient application of legal or even of social penalties will generally succeed in stopping the propagation of either. The real advantage which truth has, consists in this, that when an opinion is true, it may be extinguished once, twice, or many times, but in the course of ages there will generally be found persons to rediscover it, until some one of its reappearances falls on a time when from favourable circumstances it escapes persecution until it has made such head as to withstand all subsequent attempts to suppress it."

From John Stuart Mill. *On Liberty*, 1867.

Comment: For the scientist, never promote something or relay something or utter something that you do not believe is true. It will not sustain. At best people will just say, "he was wrong." At worst they will say, "he was a sophist and dangerous and useless and held back others." On the contrary, if you sustain truth amidst the pressures of false fashions and herd movements down blind alleys, the true thoughts will find "favourable circumstances" to rise.

(2016)

Bad weather makes good academics

“He [Chomsky] once came close to joining UC Berkeley, he admits, but California is too hot for him. ‘I like the cold weather. It means you get work done.’”

From Financial times article "Lunch with FT: Noam Chomsky", by John McDermott, March 15, 2013

Comment: I noticed as a graduate student at University of Michigan that when the Fall and Winter weather came, the university got more serious, the studying got more pervasive, the concentration deeper, and the accomplishments more copious. Cold weather focuses the mind and more intellectual work is done. It works like that for many of us, including Chomsky.

(2013)

Five characteristics of successful people

Jeffrey Mayer has made a list of the top 5 characteristics of successful people:

1. They have a dream
2. They have a plan
3. They have specific knowledge or training
4. They're willing to work hard
5. They don't take no for an answer

From Jeffrey J. Mayer, *Success is a Journey*, 1998.

Comment: Mayer goes on to say that successful people are very focused and cannot be sidetracked from their focus. They also learn that there is a connection between success and happiness. Mayer echoes the social science research in telling us that happiness does not come from what you acquire or own, but rather through "doing and achieving." Setting worthy goals and achieving them leads to success and happiness.

(2000)

True workers die in a fidget of frustration

"The true workers all die in a fidget of frustration. So much to do, and so much left undone!"

John Banville. *The Sea.* Vintage, August 2006 (paperback), 2005.

Comment: I was reminded of this quote when David Bowie died. David Bowie was a hard working musician. Just before he died he knew that he was seriously and terminally ill, and yet he was working hard up to the last moment. All true workers are like that. The successful, the committed, the active all die “with their boots on.”

(2016)

Voltaire says true physics is to calculate, measure and observe

"True physics consists then in the proper determination of all the facts. We will know first causes when we are gods. It is given to us to calculate, to weigh, to measure, to observe; this is natural philosophy; almost all the rest is a chimera."

From Tom Scharle 2004. “Voltaire’s Dispute with Epigenesis.” http://www.talkreason.org/articles/chickegg.cfm (accessed June 2006)

The quote is a translation from the entry “Cartesianisme”, which is in Questions sur l’encyclopédia Dictionaire Philosophique Tome III volume 52 of *Oeuvres complètes de Voltair avec des remarques et des notes*. Paris: Badouin Frères, 1825.

Comment: As Scharle says, “Voltaire seems to have had a limited concept of what sciences could investigate”. I tend to agree with that assessment. But this quote is also part of the overall criticism of Descartes, who believed he had solved all of physical science through pure thought, and that hubris turned out to be very misguided. The anti-Descartes crowd often ran to the other extreme, such as is reflected in the Voltaire quote above. This especially happens if the author does not understand science very well and has not contributed to it, but has strong philosophical opinions about what science should be and how it should operate. Voltaire is in this category in my view.

(2006)

Will to prove destroys art

"It's not passion that destroys the work of art. It's the will to prove." - André Malraux

Quoted in Olivier Todd. *Malraux: A life*. 2005

Comment: Inasmuch as an artist wishes to smash us over the head with a political ideology the art is destroyed. Non-art methodologies are much more suited for making an argument and proving something. This is tautological in the words of Malraux since the expression of will to prove turns would-be art into detritus. Art can show but it cannot tell.

(2009)

Nothing is my last word on anything

"Nothing is my last word on anything." -Henry James

Comment: The quote above is from a letter Henry James wrote to a complaining reader (Gorra 2013). I think this sentiment should be adopted by everyone. We do not have to be held prisoner to statements we might have made years ago. In physics we are able to adjust rather quickly, since erroneous ideas become known to be erroneous rather quickly and unambiguously many times, and so physicists are practiced in this Jamesian art. The softer the field, such as politics and religion, the more leaders feel compelled to be consistent and to project certainty. A "flip-flopper" in American politics is one who changes his or her mind, and they are ridiculed for it. However, allowing people to improve and change their minds and grow from experience should be encouraged not the opposite.

Reference

Gorra, Michael. *Portrait of a Novel: Henry James and the Making of an American Masterpiece.* Liveright, 2013.

(2013)

Cultivate the ethic of the essential

"Every novelist, starting with his own work, should eliminate whatever is secondary, lay out for himself and for everyone else the ethic of the essential!"

"The ethic of the essential has given way to the ethic of the archive. (The archive's ideal: the sweet equality that reigns in an enormous common grave.)"

From Milan Kundera, "What is a Novelist?", *New Yorker*, October 9, 2006.

All italics are Kundera's italics.

Comment: The ethic of the essential is also moving toward ethic of the archive in science. However, in literature the ethic of the archive does not make since. A novel is for art and entertainment — the ethic of the archive is just a pretention of the novelist that we should be so enamored with his/her world that all thoughts that come to the author must be expressed and read. It does not respect the reader. In science, we can have both ethics. The research paper is now generally a summary of results of what was done. It is hardly an archive of everything. Nevertheless, increasingly researchers are archiving their computer programs, their data, their calculations, and even background material that would be of use to the small group of researchers who read the published paper and want to know more. Thus, it is not ethic of the essential vs. ethic of the archive in science. Both can survive simultaneously rather comfortably.

(2007)

All have will to win but few have will to prepare

Maureen Mahoney, on success:

"Mahoney said her preparation began at Indiana University and the University of Chicago Law School. Along the way, Mahoney heeded the advice from her legal colleagues and said she even listened to former Hoosier basketball coach Bobby Knight, who said that most of his players had the will to win, but not the will to prepare. 'Success is first and foremost the willingness to prepare,' she said."

From Maureen Mahoney's 2003 Elizabeth Charlotte Mullin Lecture on October 22, 2003 at the Power Center in Ann Arbor, MI. This quote is from the newspaper article: Liz Cobbs, "Attorney points to U-M case as peak of career", Ann Arbor News, October 23, 2003, page B1.

Comment: You are not special because you want to succeed, whether that be at physics, mathematics, basketball, art or business. What makes you special is if you have the willingness to do what it takes to succeed. In sports, that is the willingness to run sprints all out during a practice when no one is watching. In physics it's doing the extra supplementary homework problems to sharpen your brain and problem solving skills. Don't stop at strong desire. Got the extra step and have strong work ethic.

(2003)

I think, therefore I am … hated

From a letter (Lennon 1993) written by the great Dutch physicist and mathematician Christiaan Huygens to the philosopher Pierre Bayle in 1693:

"Descartes had found the way to have his conjectures and fictions taken for truths. And what happened to those who read his *Principles of Philosophy* was something like what happens to those who read pleasant novels that make the same impression as true histories. The novelty of the shapes of his little particles and of the vortices was found very charming. It seemed to me that when I read his book of principles for the first time, everything went as well as could be, and when I found some difficult, I believed that it was my fault for not having properly understood his thought. I was only 15 or 16 years old. But having since discovered from tie to time things visibly false and others very improbable, I have thoroughly rejected my former opinion and I now find almost nothing I can certify as true in all his physics, metaphysics or meteorology.

"[Galileo did not have] "the boldness and presumption to attempt to explain all natural causes [like Descartes], or the vanity to become head of a school ["chef de secte"]. He was modest and loved the truth too much."

Separately, we read from Shorto (2008) this about Louis-Sébastien Mercier's 1796 speech arguing against the proposal in 1793 that the remains of Descartes be buried in the newly established Panthéon :

"'I, too [referring to Descartes supporter Chénier], made an eloge to Descartes in my youth,' [said Mercier]. But he said that he hadn't yet realized that 'the greatest charlatans in the world have sometimes been the men most celebrated.' Mercier chose to avoid combating Chénier's political argument. Instead he railed against 'the history of profound evil that Descartes has done to his country.' Descartes, he declared, 'visibly retarded progress by the long tyranny of his errors: he is the father of the most impertinent doctrine that has reigned in France. This is Cartesianism, which kills experimental physics and which puts pedants in our schools in place of naturalist observers.'"

This quote is from Shorto (2008). Additional discussion and quotes from the fascinating "Descartes Pantheon debates" can be found in Bourgeois & D'Hondt (1989), Chénier (1796) and Mercier (1799).

Comments: Descartes was a rather extreme rationalist who thought that by pure thought he could figure everything out. In fact, he thought he had mostly figured everything out. Of course, people died around him, which is an obvious sign that he hadn't solved all problems in science, but cheerfully said he would solve that very soon too. But he died himself instead. The arrogance, the conceit, the self-promotion

and the "charlatism" as some would say of Descartes, is part of his legacy. But rattling the stale cages of French science was worth it, and for that reason, among others, he is one of the greats of western philosophy and mathematics. I'm sure Huygens is rolling his eyes as I write this.

It should be noted that Descartes did have an enormous influence on French scientific history. The French fell far behind the English, for example, in experimental science and technology, and that has been noted by many French educational historians with some blame put on Descartes's influence (Shorto 2008). The English soon became wealthier and more powerful because of it. However, the French school of mathematics is probably second to none over the many decades and even centuries. This translates into outstanding theoretical physics as well. Let a thousand flowers bloom, as they say, and the French flower is beautiful and worthwhile, if different. Thanks to Descartes.

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(2010)

Martin Luther rose to top of class by studying hard

"University authorities in Erfurt sternly regulated academic life. At four each morning the bell roused students for a day of rote learning and often wearying spiritual exercises. Starting low in class ranking, Luther studied hard and moved toward the top, usually enjoying his courses."

Martin Marty. *Martin Luther*. Penguin, 2004

Comment: Martin Luther came from somewhat humble beginnings, and started "low in class ranking." But his hard work in classes, which originated from his enjoyment of the courses, made him rise to the top. The stern environment did not sway him. Students today collapse if they have a class at 9am. Not Martin Luther. His commitment level to education, study, and knowledge enabled him to seize the opportunity that he did, to become a leader and to reform Christianity.

(2009)

Reflective versus reflexive novels in modernity

John Fowles was one of the most cerebral and interesting novelists of the 20th century. Some of his work is much overblown and borders on the pretension, but I have tremendous patience and give a lot of room for somebody trying hard to reach greater intellectual heights, especially when they succeed at times.

There are many things to learn and quote from the novels of Fowles, but I found a passage that he wrote about novels to be humorous, interesting and true. In Mantissa, a literature professor is trapped in a sort of holodeck room with a beautiful women who we learn is the Muse Erato, and probably all a figment of his imagination. She acts and speaks like a simpleton, but often gets the better of the protagonist. In this exchange she asks about the role of humor in the novel. He is exasperated, since he thinks the answer is completely obvious, but he responds anyway.

Here is the passage. I will make a few more comments after.

Begin passage

She speaks in a very small voice. 'May I ask you something?'

He stands, and picks up the tie from the back of the chair.

'Of course.'

'I can't quite understand, if there's a place for humour in ordinary life, why there can't be also one in the novel. I thought it was meant to reflect life.'

He leaves the tie hanging untied round his neck, and puts his hands on his hips.

'Oh God. I honestly don't know where to begin with you.' He bends forward slightly. 'The reflective novel is sixty years dead, Erato. What do you think modernism was about? Let alone post-modernism. Even the dumbest students know it's a *reflexive* medium now, not a reflective one….'

End of passage

So very true. And yet, it is fine. The novel cannot compete with modern film when it goes head to head with it on the reflective front. Film can pack much more reflective narrative much more efficiently than a novel can. However, a film cannot have the reflexive capacity of novel without becoming deathly stultifying. Good writers can do with the novel what no other medium can, and construct a powerful piece of art.

The problem is that as one gets older it sometimes becomes harder and harder for some to believe that that twenty-eight year old MFA graduate, who is now a semi-employed waiter in New York City trying to make it, can say anything new and insightful that the reader hasn't already experienced or understood. Many people when they reach full adulthood grow tired of reflexive literature mostly out of arrogance that their own thoughts are more profound than the writer's. If they read fiction at all, they would much rather read a crime story or an adventure story that puts them in crazy scenarios in life that they would never be in. Pay the writer to expend the effort to make up the story for you, that's what they want. That is fine, but don't give up on literature. Scientists working with cold facts need an infusion of humanity beyond their daily lives. It is good for the soul, especially when reading the masters. John Fowles is one of those masters.

Reference

John Fowles. *Mantissa*. London: Triad Grafton Books, 1982.

(2012)

Foucault : j'aime bien le beau style

"Et vous me direz que j'emploie souvent un certain nombre de contorsions stylistiques qui semblent prouver que j'aime bien le beau style, eh bien je dirais : oui, il y a toujours une espèce de plaisir, un peu bassement érotique, peut-être, à trouver une jolie phrase quand on s'ennuie un matin à écrire des choses pas très drôles, on s'excite un peu, comme ça, en rêvassant, et puis, brusquement, on trouve la jolie phrase, ça fait plaisir, et on trouve du movement pour aller plus loin."

Michel Foucault as quoted in "Foucault : « Mes livres sont des espèces de petits pétards…»". Le Point, 3 décembre 2015, p. 78 (from original 1975 interview). http://www.lepoint.fr/culture/foucault-mes-livres-sont-des-especes-de-petits-petards-06-12-2015-1987559_3.php (accessed December 18, 2015)

Comment: When you first try to express through speech or writing a thought that you thought was a majestic nugget of wisdom, more often than not it comes out as a banality. Yet, with work, further reflection, care, editing, and nurturing of your ideas, the core wisdom can come out. And if you are writing boring material that just has to be done, for work or whatever, and you stumble across a poetic and excellent way of expressing it, satisfaction derives from that too. As Foucault says, there is always a type of pleasure when one finds "la jolie phrase." Michel Foucault, one of the most interesting and stylistic philosophers of the 20th century, surely felt that pleasure many times.

(2015)

Non-cognitive skills as the 'dark matter' of success

The high school dropout rate in the United States is about one in ten. Lack of high school diploma is a serious impediment to gainful employment, and also leaves highly ambiguous what level of educational competency an individual may have. During the height of World War II in the early 1940s the American Council on Education (ACE) developed a test for the military to assess skill levels of their incoming draftees. This test was redesigned in 1988 and is now known as the GED test (General Education Development test), or just "the GED."

The GED has been lauded as a chance for high school drop outs to gain a new lease on life who can prove their cognitive skills by passing the test, or can work to obtain the necessary educational skills to pass the test. Many jobs and educational/training opportunities list "High School diploma or equivalent" as necessary, and "equivalent" means GED.

You might think that those who were former High School dropouts and then went through later effort to take and pass the GED would be people on a higher track to success than dropouts who never bothered with the GED. Surprisingly, however, the data suggests the opposite.

"Controlling for measured ability, however, GED recipients earn *less*, have lower hourly wages, and obtain lower levels of schooling than other high-school dropouts." (Heckman & Rubinstein 2001).

How can this be? As explained by Heckman & Rubinstein (2001) and Heckman et al. (2011) and summarized by Tough (2012), the answer is in noncognitive skills. Success is a complicated mix of cognitive abilities (intelligence, roughly) and noncognitive skills (conscientiousness, responsibility, perseverance, etc.). It's the noncognitive skills where GED recipients often fall short.

"Dropouts who take the GED are smarter (have higher cognitive skills) than other high-school dropouts and yet at the same time have lower levels of noncognitive skills. … The GED's are 'wiseguys,' who lack the abilities to think ahead, to persist in tasks, or to adapt to their environments. The performance [annual income, unemployment rate, divorce rate, use of illegal drugs] of the GED recipients compared to both high-school dropouts of the same ability and high-school graduates demonstrates the importance of noncognitive skills in economic life" (Heckman & Rubinstein 2001; see also Tough 2012 for bracket insert comment).

Despite Heckman & Rubinstein's partial identification of the non-cognitive skills in the statement above, they do not identify the noncognitive skills, and draw a parallel to astrophysics research:

"This paper is written in the spirit of 'dark matter' research in astrophysics. We have established the quantitative importance of noncognitive skills without identifying any specific noncognitive skill. Research in the field is in its infancy."

In subsequent years there has been much effort put into this question of what traits are required for high achievers (Wells 2016), which is a very related issue. Success is correlated with intelligence (cognitive) and conscientiousness (non-cognitive). Likewise putting too much emphasis on the cognitive side at the expense of noncognitive skill development is detrimental to children's success later in life (Tough 2012).

It strikes me that Heckman et al.'s studies may be showing that non-cognitive skills are more important than cognitive. It is much better to be less intelligent but responsible than it is to be more intelligent and irresponsible, when it comes to getting and holding on to decent jobs, having stable home life, etc. Perhaps Woody Allen was right when he said, "Eighty percent of success is showing up" (Peters & Waterman 1982).

The lessons learned from Heckman et al.'s studies point to a larger role of education than just imparting cognitive skills. Getting a degree, whether it be a high school degree or a college degree, requires significant noncognitive skills that are very valuable in work and life. Employers requiring a college degree may be just as interested in the student's demonstration of perseverance than in the actual knowledge they gained.

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Wells, J.D. (2016). "Traits of high achievers." See p. 71 of this volume.

(2016)

Suppress unnecessary impulses

Mikhail Baryshnikov, one of the greatest dancers of the 20th century, has this to say about modern dance:

"Modern dance is partly a matter of suppressing unnecessary impulses." (New Yorker, 31 May 1999, p.105)

Comment: This is true in physics as well. There are many more ideas out there than you have time to work on. Choose wisely.

(2000)

Leibniz thought belief in atoms was a youthful folly

"When I was a youth I too fell into the snare of atoms and the void, but reason brought me back." – Gottfried Wilhelm Leibniz

From *Die Philosophischen Schriften* in 7 vols. ed. C.I. Gerhardt (Hildesheim: Olms, 1963). English text from A. Kenny. *A New History of Western Philosophy*. Oxford University Press, 2012.

Comment: Leibniz was correct on so many things, including his understanding that absolute space and time is an unproductive and unnecessary philosophical commitment by Newton and his gang. But on atoms, he was on the wrong side. We see yet again, there are no infallible prophets in physics. None.

(2013)

The value of studying history of science

"Finally, learn something about the history of science, or at a minimum the history of your own branch of science. The least important reason for this is that the history may actually be of some use to you in your own scientific work. For instance, now and then scientists are hampered by believing one of the over-simplified models of science that have been proposed by philosophers from Francis Bacon to Thomas Kuhn and Karl Popper. The best antidote to the philosophy of science is a knowledge of the history of science.

"More importantly, the history of science can make your work seem more worthwhile to you. As a scientist, you're probably not going to get rich. Your friends and relatives probably won't understand what you're doing. And if you work in a field like elementary particle physics, you won't even have the satisfaction of doing something that is immediately useful. But you can get great satisfaction by recognizing that your work in science is a part of history."

Steven Weinberg. "Scientist: Four golden lessons." Nature 426, 389 (27 Nov 2003)

Comment: Besides the silly and unnecessary shot at philosophy, I found this very sound advice, and agree wholeheartedly.

Now, regarding his attack on the philosophers. Did Kepler or Newton or Debye and everyone else have "over-simplified models of science"? Yes. But they were steps in progress. The progress in philosophy is a little less linear, but it is happening. And philosophy cannot be avoided. Weinberg engages in philosophy by rendering judgment on another philosophy. It is not very constructive, but it is philosophy.

(2016)

Humean destruction and Artificial Intelligence

"'Tis not contrary to reason to prefer the destruction of the whole world to the scratching of my finger."

Comment: This quote is often used to emphasize that humans cannot live by reason alone. We must have a morality that springs from something other than reason, it is thought.

I do not want to get into a discussion of whether reason is really the origin of morality. Instead, I would like to point out that this quote is most applicable to Artificial Intelligence (AI). To an AI-bot, when it has a goal (figuratively, the scratching of its finger) there is no reason why it cannot work to the destruction of the entire planet in order to accomplish it. This is the primary worry of AI in recent years. The Humean destructive impulse is its most frightening consequence.

(2016)

Thomas More and Martin Luther's vituperativeness

"Scholastic debates, if sometimes arid, had commonly been sober and courteous. Thomas Aquinas, for instance, was always anxious to put the best possible interpretation on the theses of those he disagreed with. Erasmus shared something of Aquinas' eirenic spirt; but More and Luther attach each other with bitter vituperation made only the more vulgar by the elegant Latin in which it is phrased. The pugnacious conventions of humanist debate were a factor which lead to the hardening of positions on either side of the Reformation divide."

From A. Kenny. *A New History of Western Philosophy In Four Parts*. Clarendon Press, Oxford, 2012.

Comment: My early modern history friends tell me that Erasmus was the quintessential gentleman, mimicking the old courteous debate style of the scholastics. More and Luther, on the other hand, were vicious. This led to the hardening of positions. Not clear why the debates got so pugnacious, and do not want to judge, but those times were rough and tumble intellectually.

(2016)

Four benefits any teaching innovation should have

According to Robert Wilson, as quoted below in Light (2001), these are the four benefits that any teaching innovation should have

1. It requires more active listening from students.

2. It helps instructors identify students who need special help or who lack adequate preparation for the course. In the best case it helps students identify for themselves how they are doing.

3. It improves and focuses students' writing. Responses during the last weeks of class are longer and more thoughtful and articulate than those during the early weeks.

4. It helps document for students that they are indeed learning something substantial in the course.

Comment: These are great ideas. However, it should be noted that such aspects of a course are very expensive. A professor who is teaching a hundred students at a time simply cannot implement these kinds of innovations without eliminated food and sleep, much less research, which is so critical for the professor staying sharp in their field.

Reference

Richard J. Light. *Making the most of college : students speak their minds*." Harvard University Press, 2001.

(2003)

Teaching science like a foreign language

One of the most substantial educational experiences a student has is when learning a foreign language. The student often goes in knowing essentially nothing, and after a year or so can have reasonable conversation. The student recognizes readily that knowledge was achieved. The student also recognizes that without effort nothing happens. You cannot fake it when learning Korean.

Language classes have long been recognized as ideal structures for learning. As Light (2001) says, they have 1) small class sizes, 2) instructors insist on full participation, 3) students work in small groups outside of class, 4) classes demand regular written assignments, and 5) frequent quizzes give students constant feedback. Because it is impossible to fake learning in a foreign language, instruction cannot skimp out on any of these aspects. A university that wants their students to learn another language cannot make an auditorium of 250 students listening to the professor sing "aus ausser bei mit, nach seit von zu!". Classes must be small, interaction large, and constant assessment and feedback.

There is something to learn in science classes along these lines. If we implement in a science class all five of the criteria stated by Light above, the efficacy of science teaching would surely increase.

For example, research has shown quite convincingly (Light 2001) that students who are engaged in small group learning, inside or outside of class, not only learn more but also have a richer and more rewarding college experience.

Furthermore, frequent feedback through quizzes and homework evaluation is key to learning. Not only is the student required to be engaged with the material at regular times by having such assignments, they are also obtaining the needed feedback to assess their own progress. A single big example at the end of a semester and no other evaluation keeps students too much in the dark about their own progress, and also negatively impacts engagement early on in the term.

Reference

Richard J. Light. *Making the most of college : students speak their minds*." Harvard University Press, 2001.

(2003)

Big bang cries out for a divine explanation?

Francis Collins, former directory of the National Institutes of Health, wrote a book outlining his Christian faith. In it he discusses the Big Bang briefly. Here is the quote

"The Big Bang cries out for a divine explanation. It forces the conclusion that nature had a defined beginning. I cannot see how nature could have created itself. Only a supernatural force that is outside of space and time could have done that."

Francis Collins. *The Language of God: A Scientist Presents Evidence for Belief*. Simon & Schuster, 2006.

Comment: I don't think the Big Bang "forces the conclusion that nature had a defined beginning." It doesn't say much of anything before a certain moment of time. The term "big bang" is somewhat unfortunate because it implies that scientists are committed to the notion of an explosive moment in time when the universe was born. There is no such commitment. Let me explain briefly.

As we go back in time, the temperature increases and the size of the universe decreases. If we naively extrapolate back in time there is a moment – a big bang moment – where the universe had to begin in an explosion of infinitely high temperature coming from an infinitely tiny ball singularity. But that is not required. There is at least a "second" between that explosion and the first moment that we know almost anything at all about the universe. The number of theories of what can happen inside of that second are as numerous as the people working on it. Some ideas even have us oscillating away from the "singularity". Other ideas have baby universes popping up randomly. In other words, we know very little. Thus, it is too speculative to say that the big bang theory forces any conclusions on us at all, human or divine.

(2008)

Determine never to be idle

In a letter from Thomas Jefferson to his daughter Patsy:

"Determine never to be idle. No person will ever have occasion to complain of the want of time, who never loses any. It is wonderful how much may be done, if we are always doing."

From J.J. Ellis. *American Sphinx: The Character of Thomas Jefferson*. Vintage Books, 1996.

Comment: There is probably no lesson more important that I have learned in life that idleness is one of the worst vices, and leads to many other vices. Killing time is killing life, and killing the joys of making goals and accomplishing them, and killing the chance to make a positive difference in life. Idle people are miserable, and they get more miserable in time, is what I have seen.

(2000)

Darwin's flaws make him a scientist

In a letter written by Charles Darwin to his friend Joseph Hooker:

"If I lived twenty more years and was able to work, how I should have to modify the Origin [Origin of Species], and how much the views on all points will have to be modified! Well it is a beginning, and that is something…."

From K. Korey (ed.). *The Essential Darwin*. Little, Brown and Co., 1984.

Comment: Some people have used quotes like this of Darwin (without the very last sentence) to imply that Darwin himself knew his theory was rubbish. No, he knew he landed on something big. It's just that the details and other aspects of any scientific theory need constant updating and refinement. Such recognition makes Darwin a scientist, not a skeptic.

(2003)

Wisdom from John Steinbeck's journal of a novel

When John Steinbeck wrote his masterpiece *East of Eden* he kept a journal. Many of his entries are as applicable and interesting to ambitious scientists as they are to ambitious novelists.

There is a separate discussion surround a quote form his journal on the value of theories and speculations on p. 25, which I do not include here. But there are many other quotes in his journal that are good for a scientist, and well anybody, to read. Some of them I do not agree with 100%, but they are interesting ideas to think about, so that the reader can come to their own assessments.

Here are the quotes:

"… the two great foundations of art and science: curiosity and criticism."

"You can't train for something all your life and then have it fall short because you are hurrying to get it finished."

"I think I dislike amateurs in any field. They have the authority of ignorance and that is something you simply cannot combat."

"The human mind I believe is nothing but a muscle. Sometimes it has tone and sometimes not."

"There are no good collaborations and all this discussion amounts to collaboration."

"Money always removes the charge of craziness."

"Plans are real things and not experiences. A rich life is rich in plans. If they don't come off, they are still a little bit realized. If they do, they may be disappointing…. I believe too that if you can know a man's plans, you know more about him than you can in any other way. Plans are daydreaming and this is an absolute measure of a man."

"I think the human thrives best when he is a little worried and unhappy…"

"One thing I found out in the war is that I can do nearly anything if the pressure is great enough and nearly nothing without pressure. And could that be the reason why paternalisms fail? Because they remove the necessary pressures on men? I can complain like mad but I never have done good work when there was a perfect and uncomplicated ease."

"I wish I knew how people do good and long-sustained work and still keep all kinds of other lives going – social, economic, etc. I can't. I seem to have to waste time, so much dawdling to so much work."

"To be anything pure requires an arrogance he [Steinbeck's father] did not have, and a selfishness he could not bring himself to assume."

"If you are determined to finish even if you work at night, you usually find that you don't have to work at night."

"… I had never done anything without having a problem."

"One is never drained by work but only by idleness. Lack of work is the most enervating thing in the world."

"And I'm pretty sure if I new no one in the world would ever read it, I would still do it. I wonder whether that last is true."

"How the mind rebels against work, but once working, it rebels just as harshly against stopping."

"Having gone through all this nonsense, what emerges may well be the palest of reflections. Oh! It's a real horse's ass business. The mountain labors and groans and strains and strains and the tiniest of rodents come out. And the greatest foolishness of all lies in the fact that to do it at all, the writer must believe that what he is doing is the most important thing in the world. And he must hold to this illusion even when he knows it is not true. If he does not, the work is not even what it might otherwise have been."

"But it does seem a desperately futile business and one which must be very humorous to watch. Intelligent people live their lives as nearly on a level as possible – try to be good, don't worry if they aren't, hold to such opinions as are comforting and reassuring and throw out those which are not. And in the fullness of their days they die with none of the tearing pain of failure because having tried nothing they have not failed. These people are much more intelligent than the fools who rip themselves to pieces on nonsense. And with that I will go to work."

"I need so much time to waste also. Seems to require about 4 to 1 of waste over work."

"It is too bad we have not more humor about this. After all it is only a book and no worlds are made or destroyed by it. But it becomes important out of all proportion to its importance. And I suppose that is essential. The dunghill beetle must be convinced of the essential quality in rolling his ball of dung, and a golfer will not be any good at it unless striking a little ball is the most important thing in the world. So

I must be convinced that this book is a pretty rare event and I must have little humor about it. Can't afford to have."

Quotes from John Steinbeck. *Journal of a Novel*. New York: Viking Press, 1969.

(2006)

Odious qualities bring progress?

The greater writer Evelyn Waugh had this to say about what it takes to be a great artist. The same presumably would apply in Waugh's mind to a great scientist, or any other great achiever:

"Humility is not a virtue propitious to the artist. It is often pride, emulation, avarice, malice—all the odious qualities—which drive a man to complete, elaborate, refine, destroy, renew, his work until he has made something that gratifies his pride and envy and greed. And in doing so he enriches the world more than the generous and good, though he may lose his own soul in the process. That is the paradox of artistic achievement."

From Evelyn Waugh, as quoted by J. Holt. "The Life of the Saint". New Yorker, August 13, 2001.

Comment: I have often heard people say that the truly greatest achievers of science and math (those once a generation types) are those who are a bit damaged psychologically. They are driven in part by forces that are darker than pure enjoyment. Waugh seems to come down on that side. However, I don't it's necessarily quite as bad as Waugh says. Trying to earn the love of a parent, which is not so dark as being malicious or avarice, can be a powerful force for extreme achievement, for example. Also, permanent lack of security – a sort of lack of confidence instilled by childhood trauma perhaps – may also be a major force within super high achievers. This also does not reflect as badly on the high achiever as Waugh's speculations.

(2002)

America's 19th century middling standard for knowledge

The Frenchman Alexis de Tocqueville visited America in the early 1800s and wrote up what he learned in his famous book Democracy in America. This is what he wrote about American professions, including a swipe at the quality of American science:

"In America, there are but few wealthy persons; nearly all Americans have to take a profession. Now, every profession requires an apprenticeship. The Americans can devote to general education only the early years of life. At fifteen, they enter upon their calling, and thus their education generally ends at the age when ours begins. Whatever is done afterwards is with a view to some…object; a science is taken up as a matter of business, and the only branch of it which is attended to is such as admits of an intermediate practical application…. A middling standard is fixed in America for human knowledge."

From Alexis de Tocqueville. *Democracy in America*. 1835-40.

Comment: America was too practical and too poor in the 1700s and 1800s to have much of a vibrant intellectual atmosphere. The exceptions were rare and extraordinary individuals, such as Benjamin Franklin. There is always a risk even today to abandon deeper inquirer into sciences and only focus on work with "an intermediate practical application". But no society stays strong when they cannot muster the interest for deeper thought and curiosity. Strong intellectual pursuits are correlated with societal wealth and health, and America did exactly that around the turn of the 20th century, rising to great heights.

(2001)

The more we want it to be true the more careful we must be

"In college, in the early 1950's, I began to learn a little about how science works – the secrets of its great successes: how rigorous the standards of evidence must be if we are really to know something is true; how many false starts and dead ends have plagued human thinking; how our biases can color our interpretation of the evidence; how belief systems widely held and supported by the political, religious and academic hierarchies often turn out to be not just slightly in error but grotesquely wrong.

"Everything hinges on matter of evidence. … The more we want it to be true, the more careful we have to be. No witness's say-so is good enough. People make mistakes. People play practical jokes. People stretch the truth for money, attention or fame. People occasionally misunderstand what they're seeing. People sometimes even see things that aren't there."

Carl Sagan. "Crop Circles and Aliens : What's the Evidence?" Parade Magazine, 3 December 1995.

Comment: We are seeing this problem more and more with the rise of social media. The standards of evidence are dropping fast for people to get super exercised and hot under the collar. Confirmation bias based belief and trust is so high in the modern social media world that society is being damaged by it. We need more Carl Sagan's and fewer re-tweeters of unreliable nonsense.

(2015)

Greatness requires change, improvement and renewal

"The spirit of Marriott lies in the concept that there is no finish line, no ultimate summit, no 'having made it'. … Core values and purpose alone cannot make a company great. It must also have an unceasing drive to change, improve and renew itself."

From J.W. Marriott, Jr, K.A. Brown. *The Spirit to Serve: Marriott's Way*. Harperbusiness, 1997.

Comment: Marriott Hotels are known around the world as one of the primary destinations of business travels. Marriott has much to say about what makes a company great.

The quote from Marriott's book strike me as very important for the academic. As academics or researchers we are in many ways a small business owner and our brand is our work. We have students and postdocs that are contribute and that we must manage properly. An academic never "has made it". There is always more to do, more to discover, more to see. It is exhilarating when viewed the right way. But as Marriott says, successful long careers (successful businesses!) must always change, improve and renew.

(2002)

Advice for your work life

On January 2, 2004, Ace Greenberg, Chairman of Bear Stearns, was interviewed by Charlie Rose on PBS. It was a fascinating interview, and I took notes of some of the more interesting things Greenberg said. I like his views. Unfortunately Bear Stearns was one of the casualties of the 2008 financial meltdown, but I don't think that diminishes the importance of what he said:

"I don't believe in working 20 hour days. When I am done, I go home and rarely think about the business. But when I'm there, I give it 100%. I don't go to lunch. I bring my lunch and eat it at my desk."

"I believe in punctuality. It is selfish to be late. If you have a meeting and ten people are held up because of one person, that's terrible."

"If there is one piece of advice I can give young people it is to love what you do. Some guy with and IQ of twenty points below yours who comes to work loving what he does, and you don't, will murder you. I cannot overstate the importance of this. When you love it you're into it, and you find a way to make it work."

"We get rid of people who can't get along and have troubles. They eat away all your time and energy and we do not have the skills and training to deal with people like that. We ask them to leave."

Comment: Some people get frozen by this third comment, that you must love what you do. Nobody begins loving what they do with great passion. You must have a kernel of love and interest for your work, and from there it must be developed. The more you learn your trade, the better you are at it, the more you focus on what is great and important about what you do, the more you fall in love with your work, and the more effective you are. It is a continual activity to love and maintain that fervor for your profession, and when you do, the feedback is positive and you have a chance to become extraordinary at what you do, while at the same day enjoying such an important part of your life.

(2009)

Legendary boxing trainer's advice on becoming a champion

Teddy Atlas is one of the great boxing trainers of all-time give three steps for becoming a champion.

"Never lie to yourself. Face your weakness."

"Take responsibility for everything in your life. Make yourself go beyond where you think you can go."

"Live in the world of the absolute, not in the world of the relative. There is no compromise in the world of the absolute. It's sacrifice and obedience to the absolute that makes a champion."

From "What makes a True Champion." Parade Magazine. June 2, 2002.

Comment: I especially like the "live in the world of the absolute". I tell that to students. If you're doing better than the student next to you, it's not enough. You need to go to the highest level you can. The student next to you might be a slacker, but the research calls for an all-out devotion to getting it completely right and exploring all the implications one can find. The world of relative does not make champions.

(2003)

You must study the masters

Paraphrase of comment by the great pianist Lang Lang: "You must respect the masters and study them, and then you can do your own work."

Charlie Rose Show. PBS, July 18, 2003.

Comment: This is true in physics. You must study what is known before you can do something important that hasn't already been done before. A physicists who has not gotten past first semester mechanics instruction is not going to revolutionize scattering amplitude theory or come up with brilliant breakthroughs on grand unification. You must study the great body of knowledge we already know, while at the same time keeping your own creativity and own initiative to create new knowledge. This is hard, and that is why there are so few who make truly new insights of nature.

(2003)

Rationalism is alive and kicking

"Rationalistic scientists believed that it is possible, by pure reason, first to conceive and comprehend certain very general features of the universe, and then, from these conceptions to deduce mathematically a description of what the actual empirical world was like, prior to any experiment. The role of experiment, in this interpretation of scientific method, would be as a decision procedure for testing between alternative deduced results. If one reasoned mathematically and came to the conclusion that X would be the actual situation of the world, then an experiment could be designed to check whether or not X really did occur…. Rationalism might sound strange to the modern educated mind. …. [However,] Rationalism is indeed alive and kicking, especially in theoretical physics."

From G. Gale. *Theory of Science: and introduction to the history, logic and philosophy of Science*. McGraw-Hill, 1979.

Comment: This passage shows that a large number of historians and philosophers of science believe that most scientists do not have strong rationalist tendencies, and the ranks of science are filled with empiricists. However, this is not so. Science progress is much more rapid when many different philosophical commitments are represented in its ranks. The Higgs boson discovery – one of the greatest discovers of its generation – would have never happened without a rationalistic approach described almost exactly by the Gale.

Other discoveries happen by seeing something strange that cannot be explained, and then finding an explanation for it. Some people will say that General Relativity was deduced that way – trying to explain for example the anomalous perihelion precession of Mercury. But this is surely not what Einstein was doing. He worked from a much more rationalistic perspective, and only later subjected his theory to these tests. Total devotion to finding experimental anomalies is never the full story in the discovery of great new understanding of nature.

(2003)

The technician and the scientist

"The technician wants to do something, the scientist wants to know. But we have come to realize that the best proof that our knowledge is genuine is that it enables us to do something."

B. Farrington. *Science in Antiquity*, 2nd ed. Oxford University Press, 1969.

Comment: One feature of crackpot science is that you cannot "do" anything with it. It only "explains". For example, you can say that the moon orbits the earth because green crickets with invisible ropes pull it around, but it doesn't do anything for you. You cannot make any additional predictions. The hallmark of science, however, is not so much that you can "do" things in a practical sense. It is that you can make a unified description – can identify an organizing principle for some phenomena – and then can predict it reliably. This may or may not enable you to do something practical later, but the ability to predict when phenomena and quantitatively how it will happen are two good ways to know you are doing science.

(2000)

Success through commitment

"... but when I said that nothing had been done I erred in one important matter. We had definitely committed ourselves and were halfway out of our ruts. We had put down our passage money— booked a sailing to Bombay. This may sound too simple, but is great in consequence. Until one is committed, there is hesitancy, the chance to draw back, always ineffectiveness. Concerning all acts of initiative (and creation), there is one elementary truth, the ignorance of which kills countless ideas and splendid plans: that the moment one definitely commits oneself, then Providence moves too. All sorts of things occur to help one that would never otherwise have occurred. A whole stream of events issues from the decision, raising in one's favour all manner of unforeseen incidents and meetings and material assistance, which no man could have dreamt would have come his way. I learned a deep respect for one of Goethe's couplets:

Whatever you can do or dream you can, begin it.
Boldness has genius, power and magic in it!"

From W.H. Murray. *The Scottish Himalayan Expedition*, 1951.
Goethe couplet is from Goethe's *Faust*, lines 214-30 (transl. by John Anster, 1835)

Comment: Some of the saddest and most wasteful things I have seen in my life are when multi-talented people cannot decide what they really want to do, and so commitment is never fully there. Because of that they do not succeed. Listen, if you are really great at something, it usually means you could have been really great at something else too. But you won't be great at anything unless you choose one thing to commit to. Live your life deliberately and commit. Don't wait for something else to come along to show you which way to go, while you dabble in multiple directions. You will fail that way.

(2006)

How to generate luck

"My research revealed that lucky people generate their own good fortune via four basic principles. They are skilled at creating and noticing chance opportunities, make lucky decisions by listening to their intuition, create self-fulfilling prophesies via positive expectations, and adopt a resilient attitude that transforms bad luck into good."

Richard Wiseman. "The Luck Factor." *Skeptical Inquirer*, May/June 2003.

Comment: The basic principles are also manifestly on display for all of those who are "lucky" in "stumbling" on some great discovery in physics or mathematics. Their own actions and attitudes created luck, and made them successful.

(2003)