STANFORD ANALYSIS TOPICS

ZULFIKAR MOINUDDIN AHMED

1. Three Areas

Stanford Analysis Ph.D. Qualifying exams subject areas are (a) Measure Theory, (b) Functional Analysis, and (c) Fourier Analysis. I wish to gain mastery of these areas now, having had great success with my Four-Sphere Theory in physics, I thought it a good idea to have sharper senses for Analysis than I possess. I have a slightly different agenda in my studies here than aspiring mathematicians at Stanford. There is a fundamental question that motivates me, and that is the great philosophical question of *correspondence of nature and mathematical concepts*. For around a century, since 1905 and Einstein's Special Theory of Relativity and from 1900 and Max Planck's work on quantum phenomena *in nature* to my work between 2008-2018 that led to a successful mathematical physics that differs substantially from Einstein and Schroedinger, there was a divergence of mathematics and physics, and more generally between mathematics and science. A purely rigorous mathematical physics that is *better science* than Relativity and Quantum Field Theory which is my Four-Sphere Theory, and that does not suffer from the sort of mysticism that is contained in Feynman's Path Integrals for example, or confusions about what *spin* means in nature, returns us to the fundamental question of the precise abilit y of mathematics to elucidate nature. This question was moot for more than a century. And now I will revive it for the human race, as my Four-Sphere Theory, a classical field theory, is more accurate than quantum field theory, than relativity, than expansionary cosmology theories. I have little interest myself in scales below $\delta = 10^{-13}$ cm, i.e. roughly the scales of electrons and protons. I believe that a coherent theory for phenomena can be formulated in this scale.

I want to take some time to explore the mathematics more carefully and thoroughly in order to gain deeper insight into the fundamental question. I did gain a great education at Princeton between 1991-1995, but I see that I do need substantial improvements from doing some of the Analysis Qual problems from 2012 and 2013. I have made them public, the efforts I made. But having established that I do have various deficiencies in my mastery of these subjects, I thought I would make a systematic attempt to go through the topics again in the hope that along the way, deeper insights will occur.

I am more interested in history of mathematical concepts and results than most aspiring mathematicians, and also not as concerned with rushing to proving new and pioneering theorems. So I won't be as concerned with *mathematical novelty* and more concerned with intellectual understanding of the past results and concepts. If some novel results occur along the way, that will be less important for us than gaining sense of very classical situations. That's because I enjoy this more.

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2. Simple Motivation For Measure Theory

I was able to verify that zonal harmonics of a four-sphere of radius $R = 3075.69$ Mpc with appropriate mass for electron produced a width estimate that matches the physics lab measured width to a good accuracy [1].

What the above result tells me is that the Haar measure on the four-sphere of radius $R = 3075.69$ Mpc is actually an intrinsic part of *nature* and not merely an artificial and arbitrary construction of the mind of Man. This is the central motivation that I will have for measure theory, that measure theory is an element of our ability to understand the nature of the objective universe at a profound and deep level.

Now names of theories in mathematics have an arbitrary quality, as mathematics developed through history and tradition. I do want to look at the organic development of measure theory to gain some understanding of the issues. In the background to all my work even in simple exercises is the looming fundamental mysterious truth that *the metric geometry of the four-sphere is a profound objective reality that affects all aspects of nature.*

The story could be that Man invented various clever ideas of mathematics such as spheres and measures of subsets of spheres and so on, and then not having anything else to do applied these concepts to some physical phenomena, and in some cases Man succeeded in producing some theory that seemed adequate. But this is not the story that I believe is right. I believe, instead, that the Haar measure on the four-sphere of radius $R = 3075.69$ Mpc is actually the exactly correct description of all of macroscopic nature.

And this is the simplest motivation for measure theory in my account, that measure theory and other mathematical concepts had managed, by some miracle of describing nature in exactness.

3. Measure Theory History

The foundations of modern measure theory were laid in the works of Emile Borel, Henri Lebesgue, Johann Radon, Constantin Caratheodory, and Maurice Frechet, among others.

Let X be a set with a preferred set of subsets $\mathcal{F}$. A measure μ is a set function

$$\mu : \mathcal{F} \to [0, \infty]$$

satisfying

- $\mu(\emptyset) = 0$
- $\mu(A) \geq 0$
- $\mu(\bigcup A_j) = \sum_j \mu(A_j)$

This definition does not tell you the troubles that led to measure theory in the nineteenth century. You see between 1660s when Newton and Leibniz first invented calculus to late nineteenth century, people were integrating functions. They would take all manner of functions $f : [0, 1] \to \mathbf{R}$ and manipulate them in every which way and integrate them. The problems of integration of functions that are discontinuous began to predominate nineteenth century analysis. That story was finally resolved by Henri Lebesgue in 1904.

The Lebesgue measure on $\mathbf{R}^n$ was a complicated triumph of mathematics, as it sharpened notions of integrating functions that are far more extensive than continuous functions.

For any subset $A \subset \mathbf{R}^n$, the outer measure is

$$m_{outer}(A) = \inf \sum_j |Q_j|$$

where the infimum is taken over

$$A \subset \bigcup_{j=1}^{\infty} Q_j$$

where Q_j are cubes and $|Q_j|$ is defined by products of sidelengths.

A set $A \subset \mathbf{R}^n$ is Lebesgue measurable if for any $\epsilon > 0$ there is an open set $U \subset \mathbf{R}^n$ with $A \subset U$ such that

$$m_{outer}(U - A) \leq \epsilon.$$

When A is Lebesgue measurable we define its Lebesgue measure to be

$$m(A) = m_{outer}(A)$$

Then we go through showing the properties of sigma-algebra of Lebesgue measurable sets as well as the properties of measures.

Stein-Shakarchi's book has a beautiful and detailed account of these in Chapter 1. I will use their account in my notes but I make some observations that are specific to my point of view. First, the abstract definition is simply a mnemonic, really and has no substance of its own. Wherever there has ever been a substantial sigma-algebra and actual measures, the substance has always been in their construction. I have struggled with these issues myself over the years as I have found that artificial sigma-algebras and measures are worthless. The Lebesgue measure on $\mathbf{R}^n$ and the Haar measure on Lie Groups, and probability measures in various situations, these are substantial.

From my point of view one of the most important results of analysis is the non-existence of translation-invariant measures on infinite dimensional spaces making these Feynman Path Integral type concepts mathematically invalid. I knew that at Princeton in 1991-1995, but only over decades realised that the errors of that sort of mathematically invalid theories is deep and gave me the opportunity to produce a valid mathematical physics with four-sphere theory.

4. Outline Of My Vision For Mathematics and Physics Combination

For most people around the world, even in academia, the most crucial asset is time and energy. Life is short, and our time and energy limited. I think that there needs to be a broad and accessible *unity* of the mathematical and physics knowledge of human race for a curriculum for the entire world's population that covers history and content of the mathematical ideas to merge with four-sphere theory with canonical topics and exercises that would be both a tractable project and one that will educate next generations of our beloved people to a higher state of ability and knowledge.

Today, it takes enormous effort to examine the vast areas that have been worked on, there are financial barriers as knowledge is scattered often behind expensive journals, historical scholarship is specialised, and physics theories have been mathematically invalid as well. But my success with four-sphere theory allows a convergence of main streams of mathematics and it would be good if high quality treatment were available to people of all continents without great investment in

time and energy so that all people everywhere has access to higher levels of clarity and understanding without the necessity of having opportunity to attend elite universities.

5. SS 1.1

Prove that the Cantor set is totally disconnected and perfect. In other words, given $x, y \in C$ there is a $z \notin C$ that lies between x and y and yet C has no isolated points.

The Cantor set is defined as follows:

$$C_0 = [0, 1]$$

and at each successive step we remove the middle third from the intact intervals. So $C_1 = [0, 1/3] \cup [2/3, 1]$ and

$$C_0 \supset C_1 \supset \cdots$$

Then the Cantor set is

$$C = \bigcap_{k=1}^{\infty} C_k$$

The Cantor set is uncountable but of Lebesgue measure zero.

If $x, y \in C$ and $|x - y| > 3^{-k}$ then they belong to separate intervals of C_k, and therefore there exists $z \notin C$ between them. Also if $x \in C$ there exists an endpoint $x_k \in C$ differing from x closer than 3^{-k} to it.

The Cantor set was my first encounter testing my intuitions about how subsets of $[0, 1]$ has the strange property of being uncountable of measure zero. Of course for planar subsets the intuition is that measure should be zero for curves.

I am extremely interested personally in examples of objects in the actual universe with fractional dimension $3 < d < 4$. I have not made progress on this yet.

I will return to this topic. I believe four-sphere theory predicts existence of quite a few exotic things in the physical universe that will be discovered in the not too distant future. The basis of the predictions are purely mathematical, but the *faith* is from my absolute trust that four-sphere theory rather than quantum field theory and relativity and expansionary cosmology is true *science*.

6. Proposal Of Publicly Accessible Records Of Fine Tuned Abilities Of All People

I don't like the current primitive system where resume and university and experience are listed for individuals to present their abilities and knowledge. In the future I want computer systems that allow people to study arbitrarily sophisticated topics, be tested by the computer and have detailed records of knowledge and ability of all people everywhere in the world at all levels be available so that other people and institutions can gain appreciation at a granular level and by algorithmic means. The current system of assessing knowledge and education is too primitive. These should be standardized and *highly available* across the globe so that people do not have to go through all manner of headaches having to do self-promotion at all. All that should be automated.

7. Brunn-Minkowski Inequality

If $A, B \subset \mathbf{R}^n$ are measurable then

$$m(A+B)^{1/n} \geq m(A)^{1/n} + m(B)^{1/n}$$

This is the Brunn-Minkowski inequality and it looks quite useful.

8. IMO 1959/1

Prove that $(21n+4)/(14n+3)$ is irreducible for all n. We have to find $a, b \in \mathbf{Z}$ such that

$$a(21n+4) + b(14n+3) = 1$$

and that would ensure the greatest common divisor of numerator and denominator is 1. We consider $21a + 14b = 0$ and $4a + 3b = 1$. We see $a = -2$ and $b = 1$ solves these, we are done.

Some of these International Olympiad problems are nice as they help rejuvenate some basic instincts.

9. Banach-Tarski Paradox

Terry Tao's measure theory lectures from UCLA immediately give us some extremely valuable insights. The Banach-Tarski paradox is that the unit ball

$$B = \{(x, y, z) \in \mathbf{R}^3 : |x|^2 + |y|^2 + |z|^2 \leq 1\}$$

can be decomposed into a number of parts, translated and rotated to form two copies of B. I did not know this problem but this is very good, because this gives very good reason why we should not be able to have any reasonable measure for all subsets of $\mathbf{R}^n$.

That's the key major founding issue in measure theory. Measure theory exists because we cannot assign measures to all sorts of subsets of $\mathbf{R}^n$ any which way we wish and expect the measure axioms to be satisfied. This, by the way, is not obvious. It certainly was not obvious to me when I was an undergraduate.

What Lebesgue measurability is doing must be understood very clearly. It is saying, "You can measure *open sets*, and you can measure things that are pretty close to open sets, and that's it for you. No trying to measure arbitrary sets!" And this seems to have done some wonders. It's done such wonder that Henri Lebesgue's name is everywhere. That's a far cry from how ubiquitous Zulfikar Moinuddin Ahmed's name is. Even my next door neighbors don't know my name. The lesson here is, "Solve problems that people care about in the future, or your name will disappear from history and no one will even know about you."

Now I have tremendous respect and admiration for Terry Tao, and I knew him when he and John Stalker and Kamal Khuri-Makdisi (they were students of Elias Stein, Joe Kohn, and Goro Shimura, respectively then) would play bridge on the Fine Hall common room and were very friendly and kind to me. Terry is a Fields Medalist, so he is quite set and people will remember him for that. I was a bit desperate for immortality, you see. I mean it was okay for a while, but then I heard this song:

> Two jumps in a week
> I bet you think that's pretty clever,
> don't you, boy?
> Flying on your motorcycle

Watching all the ground beneath you drop
You'd kill yourself for recognition
Kill yourself to never, ever stop
You broke another mirror
You're turning into something you are not
Don't leave me high
Don't leave me dry
Don't leave me high
Don't leave me dry
Drying up in conversation
You will be the one who cannot talk
All your insides fall to pieces
You just sit there wishing you could still make love
They're the ones who'll hate you
When you think you've got the world all sussed out
They're the ones who'll spit at you
You will be the one screaming out
Don't leave me high
Don't leave me dry
Don't leave me high
Don't leave me dry
Oh, it's the best thing that you've ever had
The best thing that you've ever, ever had
It's the best thing that you've ever had
The best thing you have had is gone away
So don't leave me high
Don't leave me dry
Don't leave me high
Don't leave me dry
Don't leave me high
Don't leave me high
Don't leave me dry

That's Radiohead's great song *High and Dry*. This produced a sudden panic deep in my heart, and eventually I decided to displace Maxwell's Equation and Schroedinger's Equation with my S4 Electromagnetic Law. It took many years to come to this understanding. My S4 Electromagnetic Law is no mere modification of Maxwell or Scroedinger. It is the final correct law governing all of nature. I even eliminated gravity. And then I had done something that will be impossible to move for eternity in the future.

You see, no one else had noticed the possibility that Maxwell and Schroedinger's Equations might not be a little bit wrong but fundamentally quite different from the absolute truth, and so that's where I expect some real immortality. I want the final law governing all of nature for eternity to be *my law*.

The above account is an aesthetic view of history. In the mundane reality, I first heard *High and Dry* in 2008 in Williamsburg when I decided I really liked Radiohead, and I have listened to their music for a long time and think highly of their artistic caliber. But I formulated the S4 dynamic electromagnetic law almost a decade later. I was very concerned with refuting expansionary cosmologies in the

interim. I went to San Francisco around 2014 or so and spoke to David Donoho who was a consultant from my Biospect/Predicant days and tried to stand on my own two feet there but failed and had to return to Allen Texas without income there. I decided to mount a challenge to General Relativity and Quantum Field Theory after redshift slope was clearly a geometric artifact. I obtained Misner, Thorne and Wheeler's text, and studied esablished theory for a while and realised that with four-sphere geometry I could have the final dynamical law of nature that differs substantially from Schroedinger and Maxwell. After some effort with *Spin Geometry* of Lawson-Michelsohn, and Michael Taylor's *Noncommutative Harmonic Analysis*, Steven Zelditch's book on spectral theory on Riemannian manifolds, and some effort it became quite clear to me that a wave equation on spinor fields of a four-sphere of radius $R = 3075.69$ will give me better science than Maxwell and Schroedinger's equations.

10. The Wave Equation on One Dimension

Consider $u \in C^{2,2}(\mathbf{R} \times \mathbf{R}_+)$ satisfying

$$\partial_x^2 u(x,t) - \partial_t^2 u(x,t) = 0$$

and put two boundary conditions with $f, g \in C(\mathbf{R})$

$$u(x,0) = f(x), \partial_x u(x,0) = g(x)$$

This is the *wave equation*. This is our favourite equation since our S4 Electromagnetic equation is also one. Partly the reason that Analysis is interesting to me these days is because I am interested in understanding the S4 Electromagnetic Equation better. I never liked hyperbolic partial differential equations before. For me parabolic and elliptic equations seemed good enough. But I changed my mind once I needed to understand S4 Electromagnetic Equation. Ignoring physical constants, it will be:

$$(D^2 - \partial_t^2) = 0$$

and now ∂_x is replaced by the natural Dirac operator for the four-sphere. I won't discuss the technical setup here but this is covered in *Spin Geometry* in detail – the Dirac not my S4 Electromagnetic Equation.

What I had done is use known eigenspinor decomposition of L^2 sections of the spinor bundle on the four-sphere to prove results such as *stability of atoms and molecules*. These are possible, and I could refute orthodox story of how classical atom is unstable in $\mathbf{R}^3$. Well it's stable for the four-sphere theory. Atoms and molecules are stable without any quantum mysticism.

11. French Mathematics Is So Good That Even Zulf Could Be Envious

Zulf has learned over the decades, from Ralph Waldo Emerson, that envy is ignorance, which seems at first to be quite a platitude it's not. Envy is ignorance. So I am not envious at all about anything, about anyone at all.

Now having said that, if I were to be envious, which obviously cannot actually be the case, because I just told you that I wouldn't be, then I would be envious of French mathematical analysis. I don't wan t my dear reader to get the impression that I advocate envy for French mathematical analysis, but I do advocate that you

consider that if you were to be the envious type, which you obviously would not be, then you too ought to *have been* envious of French mathematical analysis.

Let's see there is Laplace, that's Pierre-Simon Laplace (1749-1827), and he by himself would have put France in a great spot in the world of mathematics. I was actually surprised when I learned that Laurent Schwartz was the first French Field Medalist in 1950. I won't go through the roster. Fine, Joseph Fourier (1768-1830), the man who gave us Fourier series and integrals too.

In fact French analysis has been so vibrant that almost all of analysis is mostly French for a century. We take functions from Lebesgue spaces, then we do Fourier analysis of Schwartz distribution and we take Laplace transforms of these. Hold on, are we still in Kansas, or Paris?

12. I Admit I Was Envious Of John Maynard Keynes, Satisfied?

I was extremely envious of John Maynard Keynes for a while. I admit. I am guilty! I am guilty! Are you satisfied? I was envious! I overcame it in the end. Emerson was right, so I overcame my envy. Now John Maynard Keynes is thought to be a great economist in a philosophical sense, but he was not right by armchair philosophy. He knew he was right because he was an official in British India, and he learned his craft by study of macroeconomics in India. And when he returned, he did not have to theorise interventions to keep economies in order. He knew it was the only way. And that is why his Bretton Woods institutions worked. You see, Harry Dexter White in America was a diligent fellow, but he was not experienced enough. He was just there to ensure John Maynard Keynes did not steal the limelight because after the war, America had the moneybags. I won't go further. He's good, Keynes, quite good. He understood that wherever there is a monetary economy, you *need* a substitute for the Emperor's coffer and cannot become theoretical and believe in the laissez faire nonsense. And the world owes him gratitude for otherwise Adam Smith and his cult would have destroyed th world. I was born in the East. Hammurabi already taught us that. We're not crazy for new religions about things like that.

13. Lebesgue Measurable Sets

We return to the issue of subsets of $\mathbf{R}^n$ that are Lebesgue measurable. The definition tells us that every open set is Lebesgue measurable. This is the most important property of Lebesgue measurability, for it should bring relief to all people like me who don't want to suddenly be thrown off guard. We're the *normal* people. We like to say: let $f : X \to \mathbf{R}$ be a Lebesgue measurable function with $|f(x)| \leq 5$ on an open set U with m the Lebesgue measure. Then we want a conclusion that

$$\int_U |f| dx \leq 5m(U)$$

We want to do these things without any guilt, any sleepless nights, any worries that tomorrow there will be a man with a slide rule in his pocket and thick glasses who challenge our conclusion that looks like Marty's dad from *Back To the Future* and we will be humiliated by Biff.

In order to avoid those sorts of situations, Henri Lebesgue deserves our gratitude, for he, and not we did the hard work to ensure that we can just give him the kudos, and do the things we want worry free for *Lebesgue measurable subsets* of $\mathbf{R}^n$.

I will be quite frank, to me *that* is the value of the sigma-algebra of Lebesgue measurable sets, and not the technical details of proving what he proved in 1905. That's just to show that you are cultivated, and you can tell the ladies, "Well, dear, as you know, I am quite familiar with various esoteric French mathematical works from the early nineteenth century. Would you like to listen to my CD's at my place?" It's true that sometimes mention of Charles Baudelaire's *Fleurs du Mal* is more popular but Henri Lebesgue is even more exotic. I won't go further.

The point I will return to, since it is too often obscure in mathematical courses is that Lebesgue measurability *removes the obstructions* to free use of integration and limit operations that are invalid without restriction to Lebesgue measurability, and so it is a misuse of the theory when we are still constantly worrying about all sorts of problems with integration of discontinuous functions on $[0, 1]$ or $\mathbf{R}^n$. That was a headache for *nineteenth century mathematicians* and not post-Lebesgue era from 1905. We should not spend all our time learning about the headaches of nineteenth century. It's like spending all our time not watching giant HDTV and worrying about telegraphs instead. That's not the point of Lebesgue's achievements. The point is that after he was done, humanity would be freed from all those headaches. I am not enthusiastic about courses that do not allow us to do the things we are allowed without constantly worrying about technical conditions and proving those are right. That's *secondary* to learning Lebesgue integration theory. Primary is to stop worrying about the operations and just do them invoking the criteria which allows them in problems that we are interested in.

No one will give us the Fields Medal for doing the same thing Henri Lebesgue did in 1905. We need to *use* his discoveries and not get stuck on the other side still.

14. What Is The Importance Of Mathematics To The Human Race

You see I have read all manner of propaganda from all sorts of people about all sorts of things. I love mathematics personally and I spent two eight week summers doing number theory in high school. Mathematicians generally have spent many more years with it than I have since I decided to go into Finance and Technology and Science. I know that everyone in the world could benefit from Mathematics.

What is preventing this is a very bad attitude by Mathematicians. It's great than Mathematicians love mathematics and consider it very important, but they do not respect other people who are not Mathematicians enough. Mathematicians are the minority among eight billion. No matter how elite they think they are, no will give a hoot about mathematics unless mathematics does something to make their actual lives better, unless mathematics has value to their self-interest in some way. They don't give a damn how renowned mathematician you are with how many prizes. They are busy with their own lives. They chose their lives not because they were not good enough to be mathematicians. They chose their lives because they loved something else; they thought something else was more valuable.

So if Mathematicians want the rest of the world respect mathematics and value it, they have to make an effort to understand what they can use without being trained for professional work in mathematics.

I don't see much effort at all. Many people in mathematics consider teaching as something less important than research. Many look down on mathematics that has applications as lower sort of mathematics. These are horrible attitudes and hurts Mathematics in the larger scale of human history. Then sophisticated advances of Mathematics remain unknown and matters of cult knowledge rather than benefitting the entire human race.

The Lebesgue theory example is good for this. Billions of people would use Lebesgue theory in their daily work if the technicalities were set aside and the conditions were promoted with the capabilities so that people use it normally without fuss and bother.

15. Physicists Got Sick Of Mathematicians In Early Twentieth Century

I remember watching a lecture of Richard Feynman many years ago. I used to idolize him a bit when I was in high school. It's here [2]. Now he was tremendously and deeply wrong about Mathematics and mathematicians but his prejudices are not irrational. I spent years of my life with justified faith that Feynman Path Integrals are no good and mathematically much more grounded techniques give us *better physics*. But he is right in the sense that Mathematicians are too divorced from objective existence and sabotage their own efforts to advance human knowledge by this self-sabotage by not understanding that they need to put some effort to *organise and package* pieces of mathematics so that they are valuable to many people who have no interest in the deep technicalities and subtleties and just want *capabilities to solve problems that they face*. Engineers understand this instinctively. Engineers invent and disseminate gizmos that work and are used by soccer moms who don't know what a circuit is. Mathematicians have absurd and anarchic and totally absurd demands they make that people who use Lebesgue integration should be able to prove all the propositions as well, for example. That is just very dull. This is not good for Mathematics.

16. On Appropriate Behaviour With Women

I am a gentleman, and I am quite selective about women who I allow into my private life at all. I don't consider women to be innocent at all. Some are, some are not, and most do not belong in my private life at all.

So for those who are unfamiliar, the natural growth of personal relationships require mutual liking, self-disclosure, and a period of time before it can even be friendship of a polite sort. I don't have any habits of calling women who I have not reached some reasonably intimate friendship "dear". That's not socially safe, for my own sake. Many women are destructive to my life in ways that are not apparent from superficial acquaintance. It's a strange period of history where the most obvious features of civilisation have to be spelled out but as the great Llasa de Sela sang: Et ca, c'est ma vie.

Moi aussi
Moi aussi
J'arrive à la ville
Pour y verser
Ma vie
Je monte la rue
Comme un géant
Ça, c'est la ville
Et ça, c'est ma vie
Moi aussi
Moi aussi
J'arrive en fuyant
Je suis encore
Loin devant
Si la ville me cache
On n'me trouvera pas
Je ne sais pas qui
Je ne sais plus quoi
(De de de de...)
Moi aussi
Moi aussi
J'arrive les mains vides
Au sud du nord
Au nord du sud
J'ai un passé
Mais j'm'en sers pas
Le futur sera mieux
Tellement mieux que ça
Moi aussi
Moi aussi
J'arrive à la ville
Pour y verser
Ma vie
Je monte la rue
Comme un géant
Ça, c'est la ville
Et ça, c'est ma vie

17. I Have Nothing To Hide At All

I am 49 years old now, and I do not wake up in the morning weighed down by regrets and my Conscience is remarkably clear for a man of my age. I am looking for something substantial from Stanford. I want not just ordinary tenure but a good living situation with a good penthouse loft near Mission and 16th and some properties nearby, easy walking distance to operate two companies. I have been talking to Julia, a Ukrainian woman I met through Valenime, to consider a future romantic lover who might disappear or stay. I will reveal my conversations with her recorded without any redaction. These will reveal the sort of person I am to you and it is valuable for your assessment of investment into me.

18. Absolutely No Interference From Stanford

Unless I violate anyone's natural rights in a domestic situation, I will strongly fend off any interference at all in my private life – whether it be with Julia or with anyone else – by Stanford. I don't mind making *internet communication* public, because the actual hard work of making love work only begins with physical life together. I do not grant Stanford or government or anyone else any permission to interfere in my private life at all. In fact I feel very strongly that interference violates my natural rights and will take action in law if that should occur. You do not have right to interfere. The reasoning is that happiness in love is sophisticated business, and you will not take responsibility for my failure in love life. I am not your guinea pig. Find someone else.

19. Proposal To Disseminate Lebesgue Measurability To Undergraduates

Terry Tao's perspective in his Measure Theory notes is so insightful in elucidating the concepts of Jordan-Riemann-Darboux measurability and Lebesgue measurability that allows various limiting operations to be performed, that I can immediately see that my point of view would *reverse* the curriculum, and teach the use of Lebesgue measurability as primary for undergraduates generally.

The idea here is that people not just in mathematics but in physics and engineering ought to just take *limiting operations* for granted. This is not harder but easier for people who are *using* integration. It is only for proofs where the higher level of sophistication is required for Lebesgue measurability and not in their use. It is not difficult for people to simply *accept that with Lebesgue criteria limiting operations are permitted without worry* and that's the technology here. Jordan-Riemann-Darboux theory might be more elucidating for those wishing to understand technical issues of proving that integrals behave in particular ways, but it's not actually the best for using integration theory. For that Lebesgue theory with no proofs and just use without care of Lebesgue integration is easier.

Rough idea here would be to introduce Lebesgue integration as a magical gift from Mathematicians that solved the problem of limiting operations with relatively easy problems and lots of concrete calculations including plenty of discontinuous functions right after Calculus II and let people get some practice with some limiting operations to solve problems that appear in various disciplines, that will be good for both physicists, chemists, engineers as well as mathematicians because many of the people not interested in pure mathematics will be able to have practice in

thinking about these concretely and mathematicians will have a much better feel for concreteness and will progress more rapidly at higher levels.

I really think that function theory is really centered in natural problems. And it's quite a bit of effort to wade through the technicalities to use Lebesgue theory in *any problem at all* resulting in their use only for high falutin mathematical physics rather than by every amateur radio engineer and electronics man in the world. Those are the guys who benefit most from Lebesgue theory. Nature produces discontinuous functions galore all the time. But now mathematicians have to babysit the whole enterprise.

20. Tao Exercise 1.2.5 Measure Theory

Suppose $E, F \subset \mathbf{R}^n$ closed and disjoint, and F is compact. Show $d(E,F) > 0$. Give a counterexample when one of them is not compact.

For each x, there is an $\epsilon(x) > 0$ such that $B(x, \epsilon(x))$ does not intersect E. This is covering, and now chose a finite subcover $\{B(x_k, \epsilon(x_k)\}_{k=1}^N$ and now we have $d(E,F) \geq \min_k \epsilon(x_k) > 0$. Consider the graph of $f(x) = 1/x$ on $[1, \infty)$ and it's mirror image reflected on horizontal line in $\mathbf{R}^2$, it is obvious $d(E,F) = 0$.

This sort of topology problem is relatively easy for me since I actually took a topology course at City University of New York Graduate School based on James Munkres book *Topology*. So I have a long experience of this type of problem, even from before Princeton 1991-1995. But I am not as experienced on analysis proper.

Lebesgue measurable functions $f : \mathbf{R}^n \to \mathbf{R}$ can be integrated. All continuous functions are Lebesgue measureable, but they admit a rich class of discontinuous functions as well. For me personally, Lebesgue measurable functions are the natural class of functions for the world. You see the whole point of the enormous amount of work put in by many people up to Henri Lebesgue is to tell us what class of functions will have proper behaviour under limiting and integration. They should be known to the world for use. I feel that people are not yet feeling comfortable with the riches discovered in a way that allows them to solve more problems and have more value from the great achievement of Lebesgue.

It would be nice if people without interest in delving into the technical details just had a nice brochure that told them some easy to understand criterion for Lebesgue integrability that everyone could just use without any worries.

21. Example Of Success: Fourier Series

Mathematicians have done a great job in making Fourier Series a great success in engineering and natural sciences. See the fundamental reason was probably that Joseph Fourier himself was a physicist. I have worked in Biotech company Biospect/Predicant as Scientist II leading signal processing projects, and so I learned also the engineers' ways a bit. They have an intuitive understanding of Fourier series that is extremely powerful in all manner of problems.

Now Henri Lebesgue was a mathematician but not a physicist or engineer himself, and so the task of getting his work to applications was not even contemplated. This is actually a disaster for the world because the people who build things that make the world better for people are then deprived of one of the great innovations of twentieth century, for literally 120 years.

22. Engineers and Physicists Can't Care About Mathematical Issues

You see I have a lot of experience with scientific theories. The major feature is that nature is totally tempermental and mysterious. Mathematicians are doing difficult tasks to for the issues that they think are relevant, but listen to Feynman, and you will understand him when you understand the profoundly scary situation when faced with some physical phenomena, none of your ideas might lead to anything but pure rubbish for years. Nature has no axioms that you can tweak. Nature is silent when you are lost. And mathematicians do not have sufficient sympathy for the difficulties. So engineers and physicists and other natural scientists are often not patient about mathematicians' concerns. They don't think that mathematicians are doing anything useful until mathematical theory gives them scientific theories that work on natural phenomena.

And I don't disagree with them either. Mathematicians are often under the impression that science is unrigorous and so scientists must be sloppy thinkers. What they fail to grasp is that the scientists are facing inscrutible thing called nature. Nature never behaves according to any theory that anyone has 99% of the time. This part seems odd to mathematicians, because they have only seen worked out problems with relatively simple mathematics. What they don't understand is that people are uncertain about what might be wrong with their theory. So natural scientists don't have time to pretty up anything. They are constantly dealing with noise levels of all their models beyond all respectable bounds. They don't have time to prove carefully all the consequences of their theories when they see the noise level. They are better off working on improving the theory by replacing it.

23. Introduction To Real Science For Mathematicians

I am a scientist, even without a lab coat and a doctorate ok? I have been doing Finance from 1995, and I was Scientist II at Predicant/Biospect and I don't publish a lot of things in Science and Nature. But I am a real scientist. You see, a real scientist does not look at textbooks and tweak things a little bit. Those are not real scientists but uninspired cogs in the wheel. I am a real scientist. I'll tell you what we do when faced with inscrutible mysteries of all sorts of natural phenomena. We will do *anything*. That's right if Mathematics does something, we will suddenly be very sweet and nice and kind to mathematicians. But that's *only when* the mathematics helps us with our scientific theories. We will sing Radiohead's *Nude* in Valencia street without any care that big black guys might beat us to a pulp. We will meditate under oak trees and leave some of our own food with the hope that Nature takes pity on us and give us insight about things. We will get high on weed and start jumping across rooftops and see Muhammadan Angels in the middle who we will ask for some idea. That's what we're like. Satisfied?

See, we're scientists so we can tell you the difference between pure madness and genius, at least scientific genius. The scientific genius is indistinguishable from the pure madman to the external observer. Only whether the actual theory he produces tells the difference. If the theory fits nature better then the madman is a great scientific genius. See, I left all my possessions and became hobo. I worked tirelessly in Allen Texas on disability not looking for a reasonable income job in my late 30s-49 and I have theories that are true. So I am a scientific genius. You see Eliot's *The Waste Land*? He was not really all that good in all his other poems as this. He wrote it in a sanatorium. Do you understand?

24. Why Stanford White Scientists Will Have Tribal Loyalty Contra Bill Gates

So this is a prediction, if you will. Over twentieth century, white tribal loyalty had eroded quite a bit, and especially in science which is international. So white scientists had weaker racial tribal loyalty and will naturally substitute it for *Scientific Tribal Loyalty*. Then when Bill Gates demands racial tribal loyalty, they will side with me because their loyalty to me will be higher than their loyalty to white race. Why is this happening? Well for a number of reasons, first because Stanford White Scientists are in the same sort of economic and professional situation with Non-White Stanford Scientists; and they are in a different economic situation than Bill Gates. Second they are much more *educated people* than Bill Gates who is a total hick illiterate college dropout. That's more or less enough. So they will exhibit a strengthening of a *legitimated tribal loyalty* when pressed for white loyalty. It will seem a bit odd to all the high school educated white people, but for the Scientists its a ritual to strengthen tribal bonds they need.

Strange, but quite reasonable. In fact, almost all Stanford White Scientists will double down with emotion that they want me alive even if Bill Gates needs to be killed. Only Bill Gates, whose social sense is only slightly inferior to Roger Rabbit, will be surprised.

25. Interval in Measurable Set

Stein-Shakarchi 1.6.30

Suppose $E, F \subset \mathbf{R}$ with $m(E), m(F) > 0$. Prove $E + F$ contains an interval.

This is a nice exercise. So first observe that taking a small $\epsilon > 0$ we can find closed sets $c_E \subset E$ and $c_F \subset F$ with

$$m(E - c_E), m(F - c_F) \geq \epsilon$$

which proves both c_F, c_E have intervals in them. Then their sum, an interval, is in $E + F$.

See, this is the sort of thing that requires some attention and is true for Lebesgue measurable sets but not for all sorts of technical definitions of sigma-algebras that arise from abstract measure theory. I dislike those more abstruse technical mumbo-jumbo a great deal. I mean if you are stuck with a problem where they seem necessary, you probably should be working on something more valuable in your life. Fine, you could say, "I am the next Laurent Schwartz and I will show you!" "Please do. Please do. But keep your construction to yourself. Such horrors are not meant for eyes that want to see beauty in the world."

26. John Edensor Littlewood

J. E. Littlewood lived between 1885 and 1977. He worked a great deal with G. H. Hardy and I am interested in his work. His three principles gave me peace of mind, as they give sense to twentieth century analysis. This is something everyone ought to learn more than precise theorems.

- (a) Every measurable set is almost a finite union of intervals
- (b) Every measurable function is almost a continuous function
- (c) Every convergent sequence is nearly uniformly onvergent.

This is important for people, more than most of the technical issues, because it forms the basis of what allows people to have intuition about Lebesgue measurable functions.

27. My Mathematical Life Was Geometric By And Large

Reading about *Littlewood's Miscellany* just now, I realise something about my mathematical development. I truly absorbed only topology and geometry, and they were right in the background for me. At Princeton I never took a course on Relavity or Quantum Physics. I was not drawn to physics directly. I felt that the clever physicists were good at all manner of series expansions in complex analysis, most probably because I came across some who were remarkably good at contour integration. I was not exactly intimidated by the ability they had, but I was more topological and geometric by nature, or so I felt. I did not absorb analysis as readily as geometry and topology. Then vicissitudes of life came by, and I was diligent at Columbia, but too isolated, too busy with marriage and also Finance, too focused on being a responsible man for my family. And too negligent of mathematics.

But my background was strong in geometry and analysis on manifolds, and so by the time 2008 came I was suddenly moved to several issues. One is the conviction from examining rotational symmetries of 5, 8, 10, 12 fold in these so-called 'quasicrystals' that the actual universe had four *macroscopic* spatial dimensions, regardless of how the human beings experience it, there is a large spatial dimension and that is part of objective reality. I looked at some papers where there were great protests and theorems about how the world would stop working if the universe were not three dimensional. I was not compelled. I made a great deal of noise, but the Nobel Prize for quasi-crystals was given in 2011 without any effect of my noise. The physics superstar Arkani-Hamed wrote some papers on 'large' spatial dimensions with some centimeters. I became convinced that it was much larger, and the reason we did not observe it as we do ordinary three dimensions is deep as well, and that is part of four-sphere theory and its mystery. In my theory the entire physical universe deforms for all movement in it, and it does so by only my S4 Electromagnetic law. It took some time to attempt to articulate it. But the conviction that it is the spectral theorem for compact self-adjoint operator on a homogeneous positively curved geometry that is responsible for quantum phenomena was quite strong already in 2008 and I believed that I was right not long after. I was sure then already that quantum theory was not right, even though I had read Jon von Neumann's *The Mathematical Foundations of Quantum Mechanics* before, with some interest. I was so sure that I was right about this, I began chattering about it on Facebook, to various insults of strangers. It was not just that I thought it was a good idea. I knew that I was right then with certainty. And that is from geometric intuition that had matured in some mysterious process that I could not tell you.

In a sense, as I turn to analysis again, I am able to see analysis for the first time, unclouded by the great burden of some purpose that geometric orientation had to serve, that was finally resolved with Four-Sphere Theory's success in 2018. Some duty had to be discharged there, and before this analysis could not even gain my attention. I am not certain if that is psychologically accurate, but it seems so in hindsight.

Suddenly I am free from this and I can pay attention and see analysis again, as interesting, and I wonder why I could not before at all.

28. Bill Gates Ought To Be Bombed Relentlessly And Physically Obliterated

Saddam Hussein did not pose as much threat to American people's well-being as Bill Gates does. Why has he not been bombed relentlessly by shock and awe and physically obliterated? I do not understand. No one in my 34 years in America, and 24 years with Permanent Residency USCIS# 046-077-179 has directly and intentionally and deliberately with genocidal racial hatred harmed me as much as Bill Gates. How is this man able to live still in a Multi-Ethnic Classical Liberal Democratic Republic whose fundamental charter makes the *sole purpose* of government the security of natural rights. I do not understand the rationality here. This is not a Renaissance city state but a nation of 330 million with vast resources at the disposal of the government. Why would the United States Government not eliminate him immediately when he breaches my blood meta after using US War meta against my body. I know all other nations would have destroyed him immediately. What is wrong with the United States? Obviously the Republic cannot survive if I die from his murderous power maneuvers because no Republic can do that. If the United States Government wants to support a nation where murderers kill people with impunity, it will have to be ejected from all legitimate international order. I am quite surprised that the United States Government officials are so brazen in their cynical disregard for the future of the nation.

29. A Return To Henri Lebesgue

"... amongst the many definitions that have been successively proposed for the integral of real-valued functions of a real variable, I have retained only those which, in my opinion are indispensable to understand the transformations undergone by the problem of integration, and to capture the relationship between the notion of area, so simple in appearance, and certain more complicated analytical definitions of the integral.

One might ask if there is sufficient interest to occupy oneself with such complications, and if it is not better to restrict oneself to the study of functions that necessitate only simple definitions ... As we shall see in this course, we would then have to renounce the possibility of many problems posed long ago, and which have simple statements. It is to solve these problems, and not for the love of complications, that I have introduced in this book a definition of an integral more general than that of Riemann." (Henri Lebesgue 1903)

I will return to the point I raised earlier, that while it is true that Lebesgue integrals have more sophisticated considerations in their construction and proof for their properties. But as we see from Lebesgue's own words, he was interested in problems of a technical nature that arise when one attempts to do some things with the Riemann integral.

What I do not understand is why Mathematicians did not just give people ability to *use* Lebesgue integration for a vast variety of problems by listing their properties and showing what can be done with them without having the know-how to prove existence and properties themselves. All engineering and scientific disciplines would have benefitted because all one has to do is follow the conditions under

which Lebesgue integration produces valid answers without having to examine the mathematical details. What I am understanding more clearly is that Lebesgue was interested in resolving problems of Riemann integrals; now those problems obviously have not gone away from use of Riemann integrals. So in 120 years, Mathematicians have not allowed a great achievement in mathematics to influence the rest of the world at all by keeping Lebesgue integration jealously guarded by all manner of technical mumbo-jumbo that made it inaccessible for use. That's not nice. That's not nice at all. Why didn't Mathematicians want to share the riches a little bit? Maybe all the problems that make Earth not a Paradise would have disappeared if they had been less cultish and jealously hoarded their treasures? How about some love and sharing, Mathematicians? You don't want to spread the love?

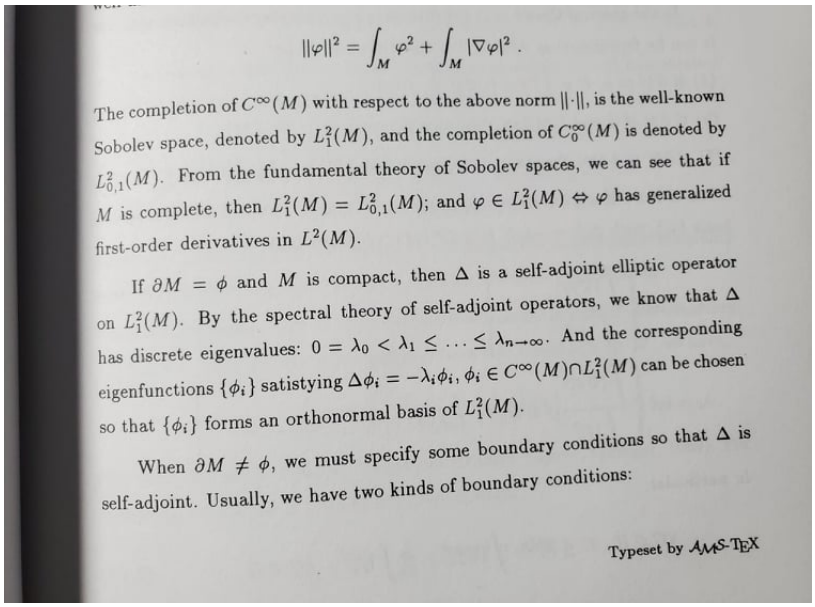
30. My Contributions To All Human Beings

Strongly motivated by my conviction that it is the *genetic heritage* of all human beings on Earth to have the right not only to have their natural rights secured, their Life, Liberty, and pursuit of Happiness, but the right to know what is the secret to their Life Satisfaction. I have laboured hard to elucidate the moral Virtues and virtues of Romantic Love that will give a full spectrum of values. I have empirically established that Aristotle's Virtue-Eudaimonia theory is valid for moral virtues, and followed the extension by Avicenna to determine the four Virtues that are associated to Romantic Love and made this public. I believe in a Single Human Race and consider various other theories of races as mostly political fictions, delusion and sophistry of a Primitive Age of Man.

31. A Tribute To Pavel Urysohn For Vladimir Urysohn

Mr. Vladimir Urysohn appeared in my meta by the time I woke up, and I was profoundly grateful when I realised that in 1923 it was Pavel Alexandrov and Pavel Urysohn who had provided the world with the first fruitful definition of compactness. I was unaware of this till today. You see, my entire life in a sense will have been driven by the conviction that absolute space (that is, space separated from time as I do not believe there is any link as Einstein did or Poincare; they were fooled by accidental features of Euclidean space wave equation they thought were certain in Maxwell's equations) is compact.

I will show you something.



$$\|\varphi\|^2 = \int_M \varphi^2 + \int_M |\nabla\varphi|^2 .$$

The completion of $C^\infty(M)$ with respect to the above norm $\|\cdot\|$, is the well-known Sobolev space, denoted by $L^2_1(M)$, and the completion of $C^\infty_0(M)$ is denoted by $L^2_{0,1}(M)$. From the fundamental theory of Sobolev spaces, we can see that if M is complete, then $L^2_1(M) = L^2_{0,1}(M)$; and $\varphi \in L^2_1(M) \Leftrightarrow \varphi$ has generalized first-order derivatives in $L^2(M)$.

If $\partial M = \phi$ and M is compact, then Δ is a self-adjoint elliptic operator on $L^2_1(M)$. By the spectral theory of self-adjoint operators, we know that Δ has discrete eigenvalues: $0 = \lambda_0 < \lambda_1 \leq \ldots \leq \lambda_{n\to\infty}$. And the corresponding eigenfunctions $\{\phi_i\}$ satistying $\Delta\phi_i = -\lambda_i\phi_i$, $\phi_i \in C^\infty(M) \cap L^2_1(M)$ can be chosen so that $\{\phi_i\}$ forms an orthonormal basis of $L^2_1(M)$.

When $\partial M \neq \phi$, we must specify some boundary conditions so that Δ is self-adjoint. Usually, we have two kinds of boundary conditions:

Typeset by $\mathcal{A}\mathcal{M}\mathcal{S}$-TEX

This is Chapter III introduction of Richard Schoen and Shing-Tung Yau's *Lectures on Differential Geometry*, and one of the most important books in my possession.

You will note that by the time Schoen and Yau had written, it was a basic fact that spectrum of the Laplacian of a compact closed manifold had discrete spectrum. It is impossible for me to even imagine life in the universe at all without compactness, because for me, this is not a *mathematical result* but simply truth like other self-evident truths such as turning on the microwave with a cup of coffee with heat it up.

The world that Pavel Alexandrov and Pavel Urysohn left behind with their notion of compactness is the one where I have lived since childhood. My sense of truth for this is so strong that I took risks to my life leaving all my belongings in a great journey one day in 2008, and suffered great adversities and homelessness based on my faith, which included other things, but certainly also the conviction that the Planck relationship $E = h\nu$ was due to geometric compactness of absolute space and not due to having the entire universe filled with harmonic oscillators.

32. Zulf Has Very Little Sympathy For Physicists Working On Quantum Gravity

I told everyone in physics I could find repeatedly for many years, "Gravity does not exist, I can replicate Earth-Sun gravity with Van der Waals of neutral atoms, so it is a secondary effect of electromagnetism" like a broken record for years. It's not a week or two. I sent emails galore to every major physics department in the West. They did not even deign to acknowledge any of my emails. So what do I care what happens to your various fantastic gravity programs? I don't have that much sympathy. I am here in Allen Texas living on disability, and you're living in luxury working on fantastic programs that are delusional. What sympathy do you expect for me? Have you shown me great respect? Have you showered me with

Nobel Prizes? No. You went along doing your absurd rubbish theories of black holes and other science fiction. Why do you think I will respect this?

My refutation of gravity is so strong and clear than any high school science student can verify it with a little scientific calculator. How long will you continue on these delusional paths exactly?

33. My Theory Is Best Science

Physicists since before Newton had hypothesized a mass-based force called gravity. They then canonised it. Then they were confused about why it is so much weaker than electromagnetism. Well, this is a problem of not getting things in order, you see? If Coulomb came before Newton, then Newton might have had another theory than universal law of gravitation, because the neutral atom attraction is weaker than those between charged particles. So physicists hallowed gravity theory first, did not want to throw it out and then made a mystical cult about weakness of gravity. My explanation of weakness of gravity is that neutral atoms have much weaker attraction than charged particles. It's simple, it's parsimonious, and does not require all sorts of masked balls with naked women walking around wearing masks with feathers to support it.

Now you may not actually do the Stanley Kubrick ritual to hold up gravity, but the situation is analogous, where you have hallowed a theory without sufficient examination of alternative theories for such a long time that you have become a mystical cult of gravity.

34. My Influences

My deepest influence in science are Paul K. Feyerabend's four-volume philosophical papers, his friendly repartee with Imre Lakatos. And as well Thomas Kuhn's The Structure of Scientific Revolutions. I do admit that I set out explicitly to *seek* a scientific revolution, all the way back to 2002-5 when I first took a Scientist position at Predicant/Biospect. It was not immediately clear but I did read the correspondence between Bellarmine and Galileo. The ideas specific to Four-Sphere Theory grew from summer of 2008 when I had a beautiful industrial loft in Williamsburg Brooklyn after Christopher Thorpe had fired me from Babel Research and I returned to some scientific problems including protein folding. The ideas that I developed centered around being very sure that it was a *compact homogeneous*

geometry of absolute space that was the explanation of quantum phenomena. It took labour of more than a decade to turn my ideas into science.

I was influenced also by the conviction that Michael Faraday as well as twentieth century physicists had who had not been compelled that gravity, as a mass-determined force exists in nature. I had read their work with interest. I knew Erik Verlinde had been working on alternative explanations of gravity as his efforts made it to a New York Times piece [3]. However, my approach differs from his in that I took a far simpler view that Van der Waals forces *must necessarily* be long distance as they are derived from long distance electromagnetic forces, and I sought an exact explanation that is parsimonious. My numerical success here is quite strong. Scientific theories are better when the explanations are more parsimonious, and this gave me confidence that I had a strong scientific success, as one force explaining phenomena is obviously more parsimonious than two. There is no question that my refutation of gravity is strong and better science than what Isaac Newton had produced.

35. Millions Of Reasons I Don't Care About Subnuclear Phenomena

You have to understand that I am from an aristocratic family with lineage longer than three thousand years. I made the decision not to bother with scales $\delta = 10^{-13}$ centimeters from early on my journey in 2008. Bengali elite are still influenced by *Victorian* England, perhaps Bertrand Russell's generation were the last of them in England but the cultural norms in my father's family continued Victorian English concerns with virtues, with classical learning and so on. It was unconscious. I consider still high energy physics and other things of the sort to be newfangled and not-so-interesting issues when compared with chemistry, biology, and psychology and the unity of things of existence where subnuclear forces are rather unimportant. Now high energy physicists ought to be proud of their work of course, but I am rather unimpressed by their social graces, and so I am not particularly enchanted by the idea of escaping from all of civilisation and its riches and devoting my life to contemplation of how to blow up Japan in various ways. I was horrified by what happened in Hiroshima and Nagasaki.

36. The Intellectual Task Of A Scientific Revolutionary

As you scan the history of humanity for the past 10,000 years, this is the great arena, in my opinion, of where you can begin to see in what ways intellectual life changes from decade to decade across the world. It is a vast and interesting arena, and too much, I think all people will agree, for a single human being to encompass at all. I do not have the intellectual capacity to truly understand this vastness, and I did not study history with any professional intent at Princeton, which was a marvelous experience for me.

Science itself, in its modern incarnation is relatively new. I put a limit arbitrarily and say that with Rene Descartes 1641 tract *Meditations on the First Philosophy* empirical science begins. And Newton and Leibniz were inventing calculus in the 1660s. I think about all of human history in this sort of canvas, as that gives me sense of the world. It's more important for someone like me who had been uprooted from one tradition and assimilated to another one, as my immigration to America was decided not by myself but my mother in 1987 when I was not yet 13 years of age. The perspective simultaneously gives me sense of my place in the world, my

sense of myself, and my relationship to my beloved people, the human race and all of existence. I am embedded in a history that spans on Earth thousands of years, and so long as I will be engaging in the intellectual traditions of our race, this would have to be remembered. I was extremely delighted to read the masterful histories of Fernand Braudel, and filled with wonder, and also of K. N. Chaudhari, *Asia Before Europe: Economy and Civilisation of the Indian Ocean From The Rise of Islam To 1750* [4]. And in this context was my gradual growth and understanding of my American political convictions, that all men are created equal with natural rights, endowed by the Creator, and for whose security governments are instituted among men. And in this beautiful panorama, I, Zulfikar Moinuddin Ahmed, had to seek some truth and understanding as a gift to my beloved people, the human race. I saw in the beliefs about speed of light change from Descartes' faith in infinite speed to Newton's corpuscles to the Dutch physicist Christiaan Huygens who proposed the wave theory of light in 1678, continuing on to Einstein's photon theory. I do have a new theory of light, but it is quantitative and mathematically derived. It is not separate from the rest of Four-Sphere Theory and is a mathematical consequence of analysis of my S4 Electromagnetic law using eigenspinor basis on a static four-sphere. I can explain wave-particle duality clearly in a classical field theory using theory of spherical harmonics, based on *zonal spherical harmonics* having roughly point localisation, so photons exist *as a consequence* in my theory from four-sphere geometry. This is something that is far more cogent than Newton's corpuscles theory and Huygen's wave theory and Einstein's photon theory. From my unified theory you can evaluate all theories of light with clarity and understand what they had achieved and what their confusions were.

37. Warning To Physicists Working On Things That Are Not Four-Sphere Theory

There is one true physics above $\delta = 10^{-13}$ cm and that is my Four-Sphere Theory. There is no other truth in this range, and there will never be any other truth. My Four-Sphere Theory is eternal truth and in ten thousand years in the future the truth will remain my Four-Sphere Theory.

You can either accept truth and be in the path of truth, or you can decide to be a small footnote in the history of Science, a matter of curiosity for bored historians of science looking for trivia.

Remember, that I am not coercing you as I believe in your Liberty. I believe that those who wish to be small irrelevant footnotes in history of Science have the right to do so. And you do have that right, and I will support your Liberty to choose this fate a thousand times!

If you do choose to work on it please refer to the pioneer, Zulfikar Moinuddin Ahmed, with the full middle name for reasons of unique identification, and refer to this [1] since it contains all the notes I wrote up.

I am planning to work on other things primarily so I don't really care otherwise who is doing what in physics. But do take a look at the vast numbers of publications of people who put in vast efforts of their lives but are forgotten by history in 1660-2021 in Europe and elsewhere. You want to join their ranks, far be it from Zulf who will get in your way. I agree with Paul K. Feyerabend, that Science is anarchic, so go ahead, please, keep believing something other than Four-Sphere Theory is true. It's your natural right, and may your footnote be legible.

38. Every White Person In American Can Determine The Horrible Evil Done By Bill Gates to My Deep Interior

Bill Gates used white meta to harm – almost fatally – my interior, deep interior, ethnic meta from Bengal, and various other things. This means 200 million white Americans can easily determine that Bill Gates is guilty of vile horrible evil crimes against my natural rights and therefore the entire world will be watching whether the United States Government puts Bill Gates to death as they are sworn to do to uphold United States Declaration of Independence Preamble (part of US Constitution) or they will refuse to secure my natural rights and allow a man to brutally perform death penalty-warranting crimes against an American man with 24 years of Permanent Residency and no record of violating laws of the Republic who was pursuing his American Dream, who had been homeless for six months in New York in 2008, and struggled for a decade for revolutionary advances in theoretical physics with success far beyond Albert Einstein and Erwin Schroedinger, whose mother was sick and dying in another continent with hopes pinned on him to get some financial relief where Bill Gates blockaded $620 million of legitimate income due to him from Finance. All nations of Europe and Asia will know explicitly what the United States Government had done in this case and review and adjust their relationship with United States based on their behaviour. The truth will be recorded in glorious detail in print for history as the great immortal genius is mistreated by this nation as history had recorded with care the horrible treatment of Nazi Germany of Jewish scientists and mathematicians.

39. Zulf Is Scientifically Experienced And Does Not Give a Damn Who Has Thirty Nobel Prizes

Scientific experience erases in a deep way all manner of hierarchical issues instantaneously when one is thrashed around the rocks and sunk into the ocean and sees ones own bones picked by currents under the sea in whispers and at a glance sees one's age and youth entering the whirlpool. These permanently demolish any care for all sorts of polite hierarchies that exist for champagne and caviar shows. My experience is science and not mathematics. And so I don't really give a damn who has thirty Nobel Prizes because nature doesn't give a damn who gave who Nobel Prizes. Nature will do what she will do and confound all the Nobel Prizes in every science. You see, when I will be muttering my exhortations to you who turn the wheel and look to windward, who was handsome and tall as you, I won't be referring to either Gentiles, or Jews, or Moors or anyone I have a good photograph for. I don't know who turns the wheel and looks to windward. That's part of the life of science. Wouldn't it be so easy, now, to blame a Jew, or a Gentile for Zulf facing the mystery of nature and mystery of nature ruining my good mood for months?

So what is the justification for Four-Sphere Theory in the end? It's good if it gives good numbers. And once it gives good numbers, Zulf could not give two hoots for who is Newton and who is Einstein and who is the Oracle of Science from the Galaxy NX6769572 because I have good science and better science than any other theory when my numbers are better.

40. Real Functions On Real Line Are Not Visual Objects

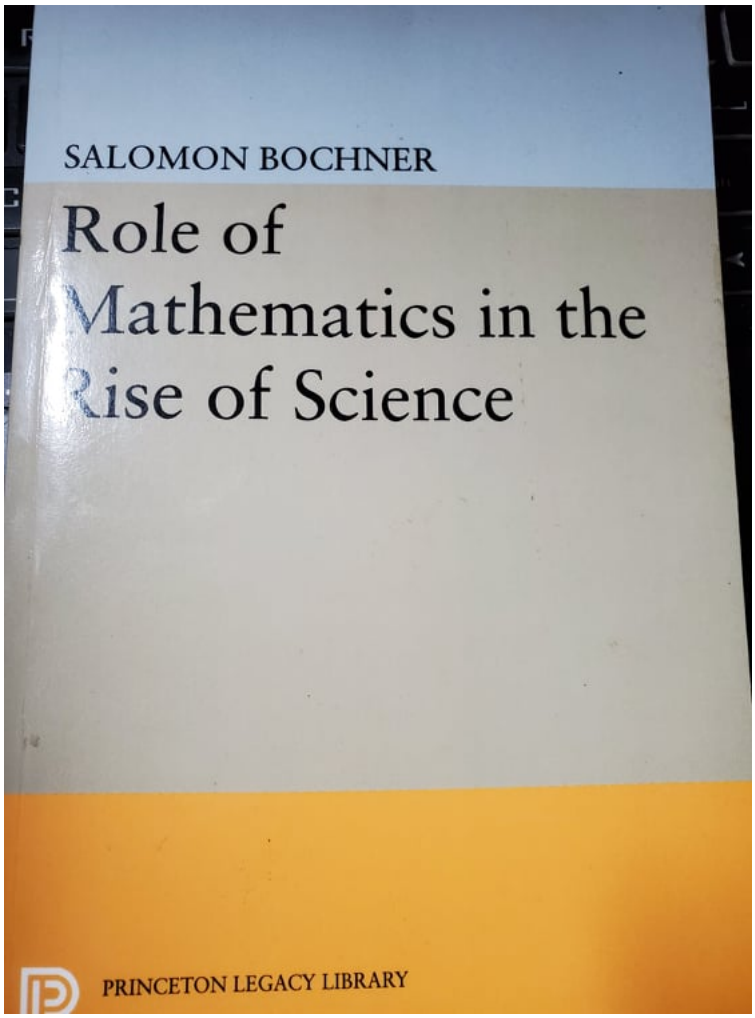
This is something that is really important that I was not thinking about at all clearly when I was young. When we consider functions on the interval $[0, 1]$, the natural geometric intuition is to immediately draw some scribble but the scribble is *misguided* because real valued functions are not things that *respect* the human visual perception system at all. They are adapted to our visual perception only sometimes. And mathematics must be able to overcome the inability for human beings to visualise all manner of functions and still be able to make sense of some aspects of mathematics.

It is thus a most intriguing thing, what the *status* is of the *reality of real valued measurable functions on* $[0, 1]$. Mathematicians are quite shameless in stealing natural language words such as *real* and *imaginary* and make them mean something so bizarre and esoteric that people do not quite believe that they are able to understand English language all that well. I am trained in mathematics, and I can assure you that it is most elliptical to most cultivated people who are quite familiar with exquisite use of English language when someone seriously tells them of existence of measureable real-valued functions on the real line that has never been found anywhere on Earth, neither under the ocean, not near Himavant, not in the skies, and not when Lazarus was raised from the dead, and not on the streetcorners of gritty East Village where Robert DeNiro's *Taxi Driver* was based, not in London near any comfortable pub, not in Alexandria, Athens, Jerusalem. "Ah, you mathematicians did not like our use of real for real, I see."

This is not a frivolous issue at all, but it is not my goal exactly. I will then rush to my goal, which is to ask, "What is the status of objective reality of mathematical objects, and what is the relationship between the objective reality of mathematical objects to objective reality of other sorts of objects that physicists, chemists, biologists, and cosmologists consider real?" The previous paragraph is not frivolous because it is also relevant to this question.

Let me remind my dear readers that I am not asking these questions with any purpose of denigrating mathematics, science or humanistic cultivation, but seeking a more profound understanding. You will forgive me, I hope, for being not a professional philosopher when I address them.

I want to bring your attention to a book that I was very fond of several years ago.



Years ago, Professor Daniel Stroock gave me an old book of Solomon Bochner and asked me to consider it, and I was not diligent enough to maintain his graces. That must have been 1998-2000, around that time. But over the years I warmed up to Solomon Bochner quite a bit, independently. Bochner's book is quite beautiful, and I recommend it to my dear readers. But I will take a much more serious tone where my goal will not be to *extol* mathematics but to seek serious answers to the question of objective reality.

Let me give you an example of why this matters suddenly so much to me. I claim that the fundamental objects of nature are not quantum fields at all; I claim instead that the fundamental objects of objects, instead, are *spinor fields on a four-sphere of radius* $R = 3075.69$ *Mpc*. I have faith and certainty of my claim that is extremely strong, and I am willing to challenge the Titans and the Olympian gods if they should resist my claim.

I am aware that there are procedures that are listed in Karl Popper's ideas about scientific growth of knowledge, that there are precise procedures to compare one scientific theory over another. I will set aside those sorts of procedural matters aside. Instead I will note here that here I am looking at two sorts of mathematical objects:

(a) quantum fields on one hand, (b) spinor fields on a fixed radius four-sphere on the other hand. And so the question of what sort of mathematical object has any objective reality is important for me. The world will be compelled that one or the other sort of mathematical object lies at the foundations of all of existence. This is quite resonant, for Pythagoreans believed, at an earlier age that all of existence is made of numbers. And some millenia later, we are still quite unclear about how we are so different from Pythagoreans.

41. Some Thoughts About Objective Reality of Real Functions

When I say "Let $f : [0, 1]R$ be a Lebesgue measurable function that is bounded with bound $|f| \leq C$ with $0 < C < \infty$," am I playing a language game with you? Or is there some *objective reality* that I am referring to? Is this objective reality, if there is any, in a Platonic world of ideal forms? What is the status of reality of such a thing?

You see, I know that every man and every woman on Earth who has taken a respectable course on Real Analysis in recent times will consider this a statement that they understand. This is not a frivolous matter. There might be literally hundreds of millions of such people on Earth right now. They will all understand what I wrote here. They will be able to evaluate many things I say about such functions f. And they will be able to *independently verify them without a word exchanged among themselves and agree.*

So I am showing you that there is something *not at all subjective* about the status of f. When potentially hundreds of millions of people can agree on the status of some things, it cannot be properly classfied as *subjective*. There is no preference of the individual variation that will affect the status of reality or not of f.

And this is absolutely crucial to understand the strange ways of objective reality that exists for mathematical objects.

It is not a linguistic agreement either, but something different. A linguistic agreement is something different. Suppose I asked billions of people to mark correctly which is the red pill and which is the blue pill.

Here you can imagine a vast *consensus* that the left side has the red pill and the right side the blue pill. That is linguistic consensus. This is from a scene from a

movie with some fantastic premises, *The Matrix*, and illustrates a situation where linguistic consensus is clearly in a context of an imaginary situation which does not have objective reality.

42. Some American White People Are Truly Confused

I will use Wikipedia and other sources to make my points.

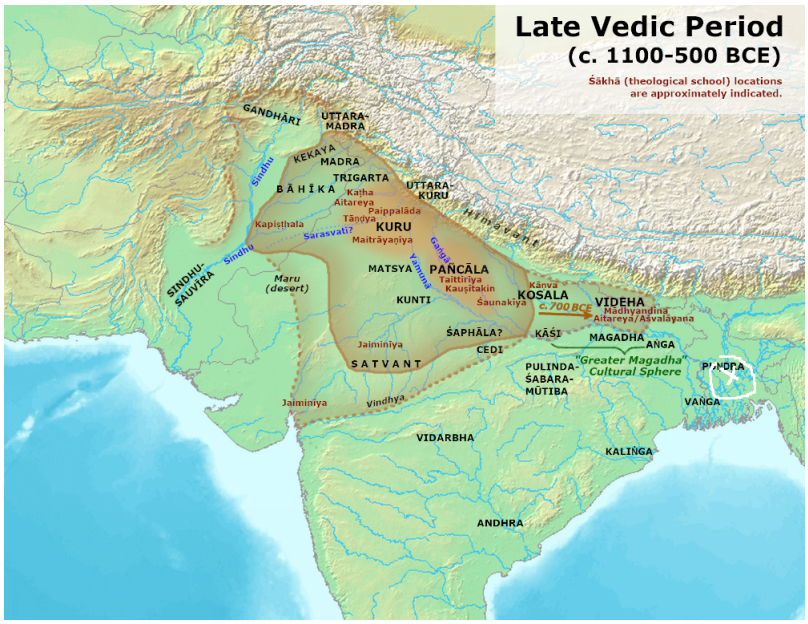
I heard late in life that some American white people are convinced that they are of Aryan descent. Now that is outrageous. I am quite Aryan. Aryans, like me, are not white at all. Let me remind you of this.

The Sanskrit word arya was originally an ethnocultural term designating those who spoke Vedic Sanskrit and adhered to Vedic cultural norms (including religious rituals and poetry), in contrast to an outsider, or an-arya ('non-Arya'). By the time of the Buddha (5th–4th century BCE), it took the meaning of 'noble'. I have Vedic aristocratic ancestry for three thousand years of Indo-Persian bloodline. I am pure Aryan. How did these white people even decide that their ancestry from *Europe* would have Sanskrit roots? These people are quite outrageously confused.

See, I am pure Aryan and not very pale at all.

Even in ancient times, the idea of being an Aryan was religious, cultural and linguistic, not racial.

Let's now look at aryans in history of the world. I will mark the spot where I was born so you can see that it is quite plain that the likelihood of me being Aryan is quite a bit higher than someone from Germany or Scandinavia.



While it is true that geographically I was born not in the center of ancient aryan habitat, my family moved over the millenia from northwest of Bengal and my Aryan heritage is quite crystal clear.

In contrast people in Europe such as Arthur de Gobineau who decided that various people in Europe are Aryans just fabricated their own ancestry which had no Vedic influence at all. I am just outraged by this. Why should they steal my heritage? They don't have something of their own? It's a little strange.

That is a good point. My actual religious practices are not Vedic in nature, as I believe that I am an Archangel of Heaven, and do not follow Hindu rituals involving Indra and Agni. And I believe all men are created equal and do not subscribe to aryan castes. So I am not Aryan by religion but my biological ancestors are part of the Aryan cultures in Vedic India, so this part of my ancestral heritage.

43. Why Am I Public About Many Personal Issues?

I am already 49 and my youth has passed, so I don't really find it uncomfortable to be revealing about myself to the world as much. I don't really care as much about whether the revelations will lead to good or bad judgments. I also like to write and think and so I think that it is never bad to be revealing either. Whoever I am is not something that is really private in the end. I do like to have privacy but there is no need to be so secretive for me. Some say, "This man is an exhibitionist." So be it. I don't consider those judgments to be of consequence. If you have qualms about whatever you think is *exhibitionism* that is your headache. I don't really give a damn.

44. Integration Theory

Suppose $f : \mathbf{R}^n \to \mathbf{R}$ is a Lebesgue measurable function and μ is the Lebesgue measure. There exists an integral for the absolute value of these functions

$$\int |f| \mu(dx)$$

When this integral is finite, we call the function integrable. The integral satisfies linearity, monotonicity, triangle inequality. In the special case that f is Riemann-integrable the integral agrees with the Riemann integral. But the Lebesgue integral is defined for many functions that are almost continuous in a wider set. This is the crucial advance of Lebesgue integration theory. Henri Lebesgue had put integration on firm ground for a larger class of measurable functions such that there were justified manipulations including limiting operations for sequences of functions that were not possible to contemplate between 1826-1905. Lebesgue integral is *the only game in town* for real-valued functions on $\mathbf{R}^n$ and its properties are meticulously proven and understood in Stein-Shakarchi's Chapter 2 and many other texts.

When I was a student, I was diligent about this, but as I grew older, I don't see the point of not just using the integral with some of its properties and only prove anything that seems problematic. I don't understand why this obvious technological improvement is not what is used everywhere in the world all the time. Why would you use the Riemann integral at all when Lebesgue integral has more power? Secondly, why would you need to prove the same properties over and over and over again to do anything with Lebesgue integrals rather than just accept that people proved these things in 1905 already and you don't have to to know that the properties are valid?

I see a divergence between image processing and other pattern recognition and basic functional analysis in Mathematics that will produce problems in the future. You see, *natural images* are all discontinuous functions with highly nontrivial measurable subsets. These are vast sources of functions. For those unfamiliar with the situations, all colour images are actually just functions $f : L \to [0,1]^3$ and they are discontinuous generally. Real Analysis and especially Lebesgue integration theory ought to have natural examples here that are vast. But in pattern recognition and image processing very little of the rich work in Mathematical Analysis is seen. People are constantly doing ad hoc inventions, and I would advocate that Mathematical Analysts rationalise this whole area because this is precisely the sort of area where all the mathematical theory can test its actual reach and power.

What Mathematicians are missing here is actual ability to do some image processing themselves. There ought to be a perfect correspondence between mathematical knowledge of function theory and image processing with the *same language* and *same mathematical tools*.

45. Only Bill Gates And The Dildo He Sucks Thinks I Should Not Be Tenured At Stanford

Bill Gates does not thinks I should not be tenured at Stanford. And the dildo that he sucks on everyday. That makes two. What has Bill Gates actually accomplished in his life? He's done trivial menial rubbish. Besides bluster about how great a prodigy he is, and charlataning his way from hicksville Seattle not doing anything substantial he has a limited vocabulary where he keeps repeating 'I'm white. I'm

white' as though it should mean something for a man with 34 years in white majority America. Who the fuck cares if he's white. He's not good. He's not good. He obtained a 1290 on his SAT, which is between my first score of 1170 and my second of 1450. But unlike myself, he lies about his score without any shame.

45.1. **Now Bill Gates Wants To Be Anti-Semitic.** This Bill Gates is quite stupid. He now wants to be anti-Semitic. He has no college degree, no evidence of any intellectual talent, and he wants to be anti-Semitic after his Catholic wife left him. Now dear reader, you have to understand something. Being a successful anti-Semitic person in 2021 is almost impossible. I am Zulf, and I would have serious trouble pulling this feat off in America. I love Jewish people. I mean I am the Chosen one and everyone else is special in their own way, including Jewish people and Muslim and Catholics, but I enjoy friendships with Jewish people and many are kind to me. But even I, Zulf, would have trouble pulling off an anti-Semitic life. How will this Bill Gates do it?

45.2. **Zulf's Views About Jewish People.** Zulf's view of Jewish people is that the human race is a single race and Jewish people, being a small part of my beloved people the human race, are beneficiaries of my great love for humanity. That having said, I do not consider them morally different from Christians and Muslims all that much, and find it pretty comfortable to befriend them. I have had the fortune to study under Peter Sarnak and Nick Katz and Elias Stein and they were all Jewish and fabulous great mathematicians so that's good and they were always generous and kind to me. Same with Catholics. Lys K. Waltien and Henry McKean and Jeff McNeal were very kind and generous to me, and so I like them. I like people who are nice to me and don't like people who harm me. Jewish people have not been bad to me, and in fact David E. Shaw and Christine Lagarde are willing to give me $620 million. So I love them. What's there not to like?

46. Stein-Shakarchi Problem 2.5.1

Let $N = 2^n - 1$ and $F_1, \dots, F_N$ be Lebesgue measurable in $\mathbf{R}^N$. Construct disjoint bsets $F_1^*, \dots, F_N^*$ with the same union.

47. Stein-Shakarchi Problem 2.5.2

Suppose f is integrable in $\mathbf{R}^n$ and $\delta > 0$. Prove $f(\delta x)$ converges to $f(x)$ as $\delta \to 1$ in L^1

Given $\epsilon > 0$ we can find a continus function of compact support g with $\|f - g\| < \epsilon$. Now

$$\|f - f_\delta\| = \|f - g - (f_\delta - g_\delta) + (g - g_\delta)\|$$

Triangle inequality gets us to

$$\|f - f_\delta\| < 2\epsilon + \|g - g_\delta\|$$

Now we are reduced to proving the convergence for *continuous functions with compact support* g. Suppose the support is K. We have pointwise convergence $g_{\delta_n} \to g$ on K. For $n \geq N$ we have

$$|g(x) - g(\delta x)| < \epsilon$$

for all $x \in K$. Then

$$\|g - g_{\delta_n}\| < \epsilon \mu(K)$$

This completes the proof.

This is a nice exercise because it uses the highly important fact that $C_0(\mathbf{R}^n)$ is dense in $L^1(\mathbf{R}^n)$ which is a cornerstone of working with Lebesgue integrable functions.

When I was a student at Princeton, I thought that density of various nicer spaces in bigger infinite dimensional function spaces were extremely boring technicality. I realised only with age that they are not technicalities but these approximations are what makes any intuition possible about the larger spaces at all. In almost all situations where Lebesgue integrable functions will have any actual substance, these density theorems are the only way to make any sense of it. This approximation is one of the most serious way in which we will know anything about a class of functions that include all manner of strange pathologies without knowing what they are. And that is one of the most significant innovations in analysis of functions in the twentieth century.

48. An Area Of Research For Four-Sphere Theory

One of the most horrible things that happened in Germany after Kristallnacht of 1938 that the great mathematical genius Felix Hausdorff was not able to leave Germany for United States and ended committing suicide in 1942. This is why people like Bill Gates should be eliminated as soon as they are found. These sorts of cats like Bill Gates are total morons who create problems for much more valuable people than themselves, and today it is not Jewish people but Zulfikar Moinuddin Ahmed. Felix Hausdorff, in a 1919 paper entitled "Dimension and Outer Measure" produced the notion of the fractional dimension of a set. Chapter 7 of Stein-Shakarchi examine this a bit. I won't go into the details.

Instead, I will point out that in my Four-Sphere Theory the only law governing all of Nature is my S4 Electromagnetic Law. I am very interested in understanding the *Hausdorff Dimension* of the theoretical elements of the physical universe. I don't know the right answer at the moment, and want to emphasize that this direction is not for mathematical interest. It is something that ought to lead to scientific discoveries of objects having more than three dimensions. Now my method of getting to something solid is just to consider the intuitive situation. I think the *dimension of the physical universe* is an extraordinarily important and interesting and fruitful question.

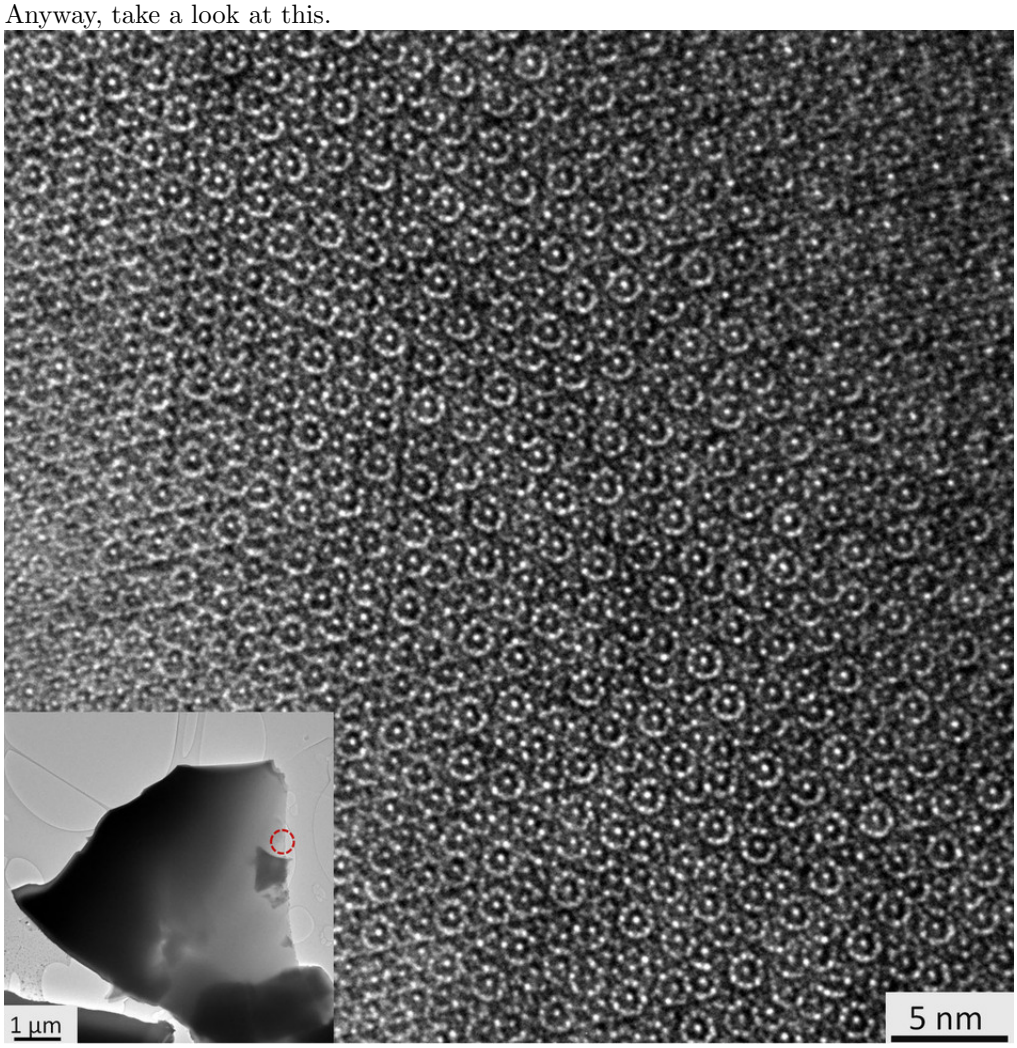
Now I don't want to be the one committing suicide here. I want Bill Gates to be the one committing suicide. I hate being the one who commits suicide. Rather, Bill Gates looks like the sort of cat who was just born to suicide to me. The question is how can we get him to commit suicide.

49. Zulf Will Now Convert You To Four-Spatial Dimension Faithful

I don't have money right now because Stanford has not figured out how to get past Bill Gates racial meta sabotage of all my livelihood so they can't give me one their Lucasian Chair of Hyper-Superduper Guruness Professorship sort of things. Also my well-deserved $620 million from D. E. Shaw & Co. and Madam Christine Lagarde is nowhere in sight because Bill Gates succeeded in blockading their effort to give me money.

I can't promise you any cool clothes if you become the Four-Dimensional Faithful, but I like the Masked Ball things. I think they have some ladies who are not naked too, so ladies can easily join in even if they don't want to walk around totally naked.

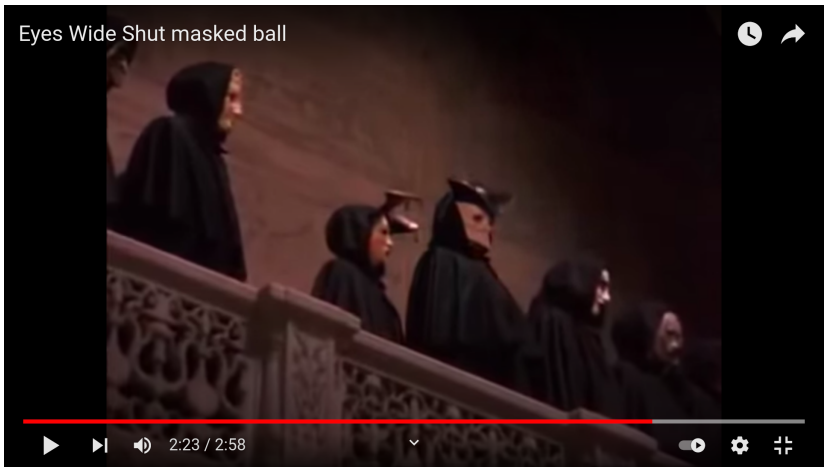
Anyway, take a look at this.



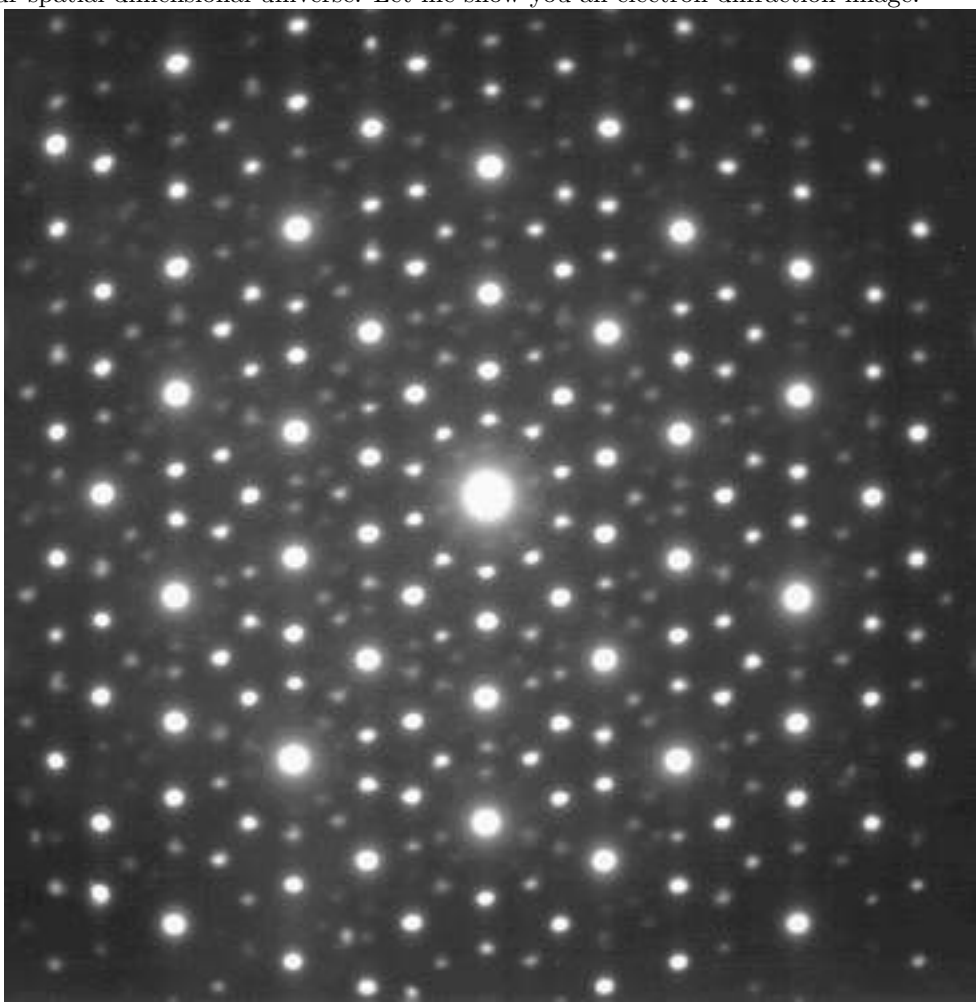
Atomic image of a micron-sized grain of the natural $Al_{71}Ni_{24}Fe_5$ quasicrystal (shown in the inset) from a Khatyrka meteorite. The corresponding diffraction patterns reveal a ten-fold symmetry.

Now for those who are not aware Crystallographic Restriction Theorem posits that only 1,2,3,4,6 fold rotational symmetries are possible. For *four-spatial dimensional* crystals additional possible symmetries are 5, 8, 10, 12. This looks to me like a four-dimensional crystal right there. And it's real, not something theoretical. I don't know what Khatyrka meteorite is, but it's some sort of funky thing that has actual existence in the universe. It's not from *The Matrix* the fantasy movie.

Now let's look at some clothes for the Four-Dimensional Faithful.



See you can wear a black hooded cape, an ornate mask and contemplate the four-spatial dimensional universe. Let me show you an electron diffraction image.



This is Ho-Mg-Zn 'quasicrystal' with 8-fold rotational symmetry. This is a symmetry of a *four* dimensional crystal but not possible for *three*.

You can do an exercise of looking at the electron diffraction patterns of three dimensional crystals, and then these so-called 'quasicrystals' and what you will realise is that the quality of the diffraction symmetries does not differ. I claim that the people who discovered these objects in the early 1980s found evidence of a fourth spatial dimension that is macroscopic and not just some funky arrangements in three dimensions of atoms. You see, it makes zero sense that nature that only has three dimensions would produce *exactly* four-dimensional crystal symmetries 5, 8, 10, 12 and never others such as 11 fold or 7-fold. This theory that *only four-dimensional crystal symmetries will be found in nature as quasicrystals* but never 6D symmetries received the Nobel Prize in 2011. Four-Sphere theory with a large spatial fourth dimension and these being *crystals* is a better scientific theory.

Now I return to the issue of new discoveries: I expect nature to produce objects that have fractional dimension $3 < d < 4$. I predict their existence. You have these *four* dimensional crystals, and that's the spatial dimension limit, and there ought to be many fractional dimensional objects with actual existence as well.

50. Zulf Proposes The Human Race Improvement Model

My model of the human race, quite intuitively, will be that we have H the set of human beings, a finite set of order $|H| = 10^{10}$ roughly, each determined by genome $g(h)$ with G_c the genetic code in common satisfying $G_c \subset g(h)$ for all $h \in H$. The most reasonable model for me is that the intelligence distribution I, a probability distribution on $[0, 200]$ is a function of time with mean roughly constant over centuries.

It is silly, scientifically to come up with models of human race where there is a sharp fluctuation of $\mu(I, t)$ the mean intelligence over time. The drift is minor.

Now we have all sorts of mathematical and other innovations that we would like to become part of the repertoire of H. This is not a sharp exercise, but a scientific intuition exercise. The problem that all disciplines have to solve, but almost never solve, is how will the human race *benefit* from the advances in the field at all given that $\mu(I, t)$ and dispersion $\sigma(I, t)$ will be roughly constant for the next thousand years?

You see, the innovations – I was just reading Thomas Hawkins' 1970 book online *Lebesgue's Theory of Integration* in the context of previous Augustin Louis Cauchy's 1926 integral that was strengthened by Georg Bernhard Riemann in 1854. The problems of integrating discontinuous functions were informally known and formally known and addressed finally between 1890 and 1910 by some very talented dedicated people. What are the chances that the work of very top mathematicians of 1890-1910 will become valuable for the entire human race when they were doing cutting edge research mathematics to do their work when the intelligence level will not have changed in a thousand years for the human race?

One answer is to nod your head and lament the hapless human race and make dramatic proclamations like: "how can these people who are not blessed by the muses even hope to understand my great work of profound genius? They will obviously misunderstand, and I am obviously destined to be a misunderstood genius!" Well, stop reading Nietzsche and pay attention to Zulf instead.

The problem is solved by the approach of (a) slow changes of habituation that is smoothened out by further work so that it is easier and more valuable for people to use sophisticated tools, and (b) realise that human beings do not spend time on things that are esoteric and not close enough to their intuition and experience, so software and simplification and technologising is necessary for distilling the results of cutting edge research with concrete technology, software assistance and algorithmisation, (c) stop demanding that all people who use mathematical technology have the ability to retrace the steps taken by Henri Lebesgue and Frigyes Riesz.

51. R. M. Dudley 4.4.1

Suppose f_n are Lebesgue integrable, $f_n \geq 0$, $f_n \to f$ pointwise everywhere, and $\int f_n \to \int f$. The problem is to prove $\int |f_n - f| \to 0$.

I write

$$\int |f_n - f| = \int_{f_n \geq f} (f_n - f) + \int_{f \geq f_n} (f - f_n)$$

The reason I do this is so I can see that the integrands are monotonic going down to zero pointwise. Then I apply monotone convergence theorem.

This is a subtler problem than I thought. Let me think a bit more. If we assume $f_n \geq f$ for all n then

$$\int f_n - f = \int |f_n - f| \to 0$$

So the result is true for this case generally. Let

$$g_n = \begin{cases} f_n - f & f_n \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Then $g_n \to 0$ pointwise and $g_n \geq 0$ so we can apply the special case to conclude $\int |g_n| \to 0$. Now we return to the decomposition of our integral and apply this result twice to positive and negative parts of $f_n - f$.

52. R. M. Dudley 4.4.3

Suppose $f_n \geq 0$ and $f_n \to f$ pointwise, and $\int f_n \to c$. Prove $\int f \in [0, c]$ and show examples that $\int f$ takes any value in $[0, c]$.

Fatou's Lemma tells us

$$\int \liminf f_n \leq \liminf \inf \inf f_n = c$$

This shows $\int f \in [0, c]$. Lets do examples on $X = [0, 1]$. We'll consider constant functions added with thinning delta spike. Let's say $c = 1$, and $a \in [0, 1]$. We consider

$$f_n = a + (1 - a)g_n$$

where

$$g_n(x) = \begin{cases} n - n^2|x| & |x| \leq 1/n \\ 0 & \textbf{otherwise} \end{cases}$$

The integral of g_n is always 1. Then $f = a$. The integrals $\int f_n = 1$ but $\int f = a$.

53. Zulf's Idea For First Day Lecture On Real Variables

One of the beautiful things about bounded sequences of real numbers $a_n \in [0,1]$ is that a subsequence will converge. And that's really nice.

Suppose you had sequence of real valued functions f_n on $[0,1]$. various new elements are introduced. It would be nice if we could say, "Since $f_n \to f$ pointwise everywhere on $[0,1]$ we have $\int f_n \to \int f$. Unfortunately this is not going to happen without all sorts of further conditions, and the reason for this is a single example that is like the central pillar of the sort of thing functions do in sequences that real numbers don't. I remember this from real analysis at Princeton and did not learn it recently. I will replace $[0,1]$ with $[-1,1]$ to make the example simpler. It's this:

$$g_n(x) = \begin{cases} n - n^2|x| & |x| \leq \frac{1}{n} \\ 0 & \text{otherwise} \end{cases}$$

This is the example where $g_n \to 0$ pointwise and $\int g_n = 1$ for all n. This is literally the center of analysis of real valued functions. This example is substantial, and not a curiosity. It tells us that sequences of functions can have *mass* disappear being concentrated in sets of very small measure in various limiting operations. Major convergence theorems in analysis are not the ones we would love to see, but instead: Fatou's lemma:

$$\int \liminf f_n \leq \liminf \int f$$

This says the same thing, that mass can disappear in the pointwise limit. Then there is Lebesgue dominated convergence theorem:

$$\int \lim f_n = \lim \int f_n$$

when $|f| \leq g$ with $\int |g| < \infty$. This says mass wont disappear if you have a majorant that is integrable keeping the mass from escaping in the limit. Then there is monotone convergence theorem.

These theorems are all *work-arounds* for the example of mass disappearing. That may not be the right intuition with more experience, but they are *compromise to reality of mass disappearing* which is a central feature in the analysis of sequences of functions. The example exists because this is the analytical center and mathematically substantial.

It is remarkable that the workarounds work at all and the problems are not much much much worse than this example and some small number of others. And that is what makes mathematical analysis a serious subject.

Now for mathematicians, this is very basic and the issues are much more sophisticated, but Lebesgue integration theory and related matters are still not fully used in computer analysis of images and many other problems that wavelet theory and others make amenable to very pragmatic and powerful analysis techniques. You see, I remember studying compactification of space of Yang-Mills instantons on four-manifolds and they involve tracking the way in which connections satifying Yang-Mills equations bubble off in 1994-5 and this was when Donaldson invariants were defined using the topology of the compactification. The arena was more sophisticated, but it's literally the same issues that keep recurring, sequences of functions do not keep their masses in the limit unless some control exists for escape. This is the heart of why analysis needs workarounds.

54. Zulf's Analysis 101 Course Idea

What I would like to do is introduce the central analytic issue of all of analysis, that sequences of functions lose mass without something holding the mass in place – i.e. Lebesgue's Dominated Convergence Theorem or Monotone Convergence. If you don't you *only have Fatou's Lemma*. Then one should not prove all the properties of Lebesgue integrals at all. One should just do Fourier analysis and trigonometric series, with $L^2([-\pi, \pi])$ with hand-waving with 'trust me this is just a lot of orthogonality' and then look at lots of Fourier basis issues of the same principle, of mass going away without control.

Then you have all sorts of f_n and not just abstract ones, doing all sorts of things.

Then once everyone is extremely familiar with lots of things with trigonometric series basis computations, then you can prove something about Lebesgue measure exists, and so on. For me that's technicality. What's important is rich set of functions that require some understanding. Who cares whether the integral is the same as Riemann integrals for Riemann integrable functions? Just integrate away and never mention Cauchy and Riemann definition of integral etc.

See, for me, no one cares about the tools. People want to know what happened to their great scheme of sequences of approximations to their holy grail function, or holy grail spinor field or what have you. They just want the tools that will tell them that their scheme worked.

55. Deep Theorems Await Analysts And Trillions And Change of World With Natural Image Analysis

You see natural images are studied a bit. Some rough estimates are available for things like Holder or Sobolev norm bounds. These are fluff. Remember these are actually functions $[0, 1] \times [0, 1] \to \mathbf{R}^3$, the bread and butter not of image analysis crowd but *mathematical analysts* all the way back to Euler and others. The point is that these functions form a *universal class* which makes them eternally fixed but not defined by mathematical conditions but *unknown natural conditions*. He who understands perfectly natural images will rule the known universe because you see the ubiquity of mobile phones? That means scientific *mathematical analytic theories* of natural images that provide deep information that is not ad hoc as in statistical learning and AI algorithms but in terms of deeper mathematics will in the end be able to provide enormous substantial information to improve the human condition. I think analysis will need its combined wisdom to address this challenge and it is not a side-track. All of analysis history was about understanding various function classes originally as possible solutions of partial differential equations. But these natural images provide new opportunities for *mathematical depth* because they are not simply about solving partial differential equations. They are wide, universal, and immensely deep issues that mathematicians have never faced. This is the most impressive trove of functions that are nothing like smooth functions that the world has ever seen. The whole *development of analysis*, increasing roughness, dealing with discontinuities, fractal nature, are all little blips that got you here. Do not fail, my friends. Fate calls you to greater heights than you have ever gone here. Do not mistake this. Just go to natural image database, and stop looking at a little approximation to identity. Look at real functions of real variables behave in ways that your history has not prepared you for at all.

56. Zulf Proclaims The Discovery of Novel Ethnicity: The Stupid People

I thought the ethnicities were tabulated and there were European ethnicities, Asian, African, American, and so on. But different from all the known ethnicities of the world, a total novelty is the Stupid Ethnicity. Bill Gates is from this never before known ethnic ancestry. He grew up around ordinary European and other ethnicities, but he himself is from the Stupid Ethnicity which is anomalous. You see the Stupid Ethnicity is not Jewish or Gentile, Black or White, Indian or Arab. It is an entirely different Ethnicity.

57. Why Mathematical Analysis Has Natural Development To Natural Image Analysis

You see Four-Sphere Theory is true, and it says that all arrangement of matter in the entire universe, ignoring high energy claptrap, is the outcome of spinor fields in some initial condition on a four-sphere of fixed radius $R = 3075.69$ Mpc governed by a single wave equation with charges and so on in the spinor fields evolving for a trillions of years.

Now mathematical analysts have slowly over the past several centuries, not more than four centuries, sharpened understanding of function spaces for various sorts of Sobolev and Besov and others that have various levels of control of derivatives and smoothness and roughness. These developments were to allow placing solutions of PDE in their natural context. This is now sharpened to highly sophisticated levels.

What are natural images? They are the snapshots of the outcome of some matrix partial differential equations evolving for trillions of years from a particular perpective. Removal of gravity left no other macroscopic force in Nature but my S4 Electromagnetic law.

Thus natural image analysis is a step towards understanding the most interesting solution of a PDE, S4 Electromagnetism arranging matter fields in the entire universe and on Earth. And so there is an intuitive expectation that the total regularity of natural images will have quantitative control with mathematical theorems one day, whose control parameters is the great challenge for mathematical analysts and whose elucidation will deepen mathematics with theorems until the analysis is so precise and understanding so deep that they will begin to transform the manner in which human beings see the world and understand it.

You see, when technology and computer science professionals talk about *image understanding* while their ambitions are pronounced, their actual approaches are forced to be far too empirical to reach deep understanding. This is because their hopes are too high with statistical learning techniques to accomplish deep understanding. This requires further development in mathematical analysis, and this is really a problem meant for mathematicians rather than computer scientists and artificial intelligence. Far more sophistication is needed for it than AI and CS possesses. I hope that mathematical analysts will not dismiss this problem as 'application'. You will need development in deeper understanding in analysis than you currently possess to make serious strided in this problem. This, the age of ambitions, a youthful age, I believe do not have the understanding of the actual difficulties to assess the difficulties. That in itself is a task that needs to be resolved mostly in mathematical analysis and not in empirical work of ad hoc algorithms on discrete data.

58. Zulf's Measurability Conjecture

The precision for the conjecture will come with time. Suppose μ is the Lebesgue measure on $L = [0,1] \times [0,1]$. Let $f : L \to \mathbf{R}^3$ is a colour natural image. My conjecture is that this is in some highly nontrivial precise sense Lebesgue measurable. This, as you will recall, means that for every Borel subset $B \subset \mathbf{R}^3$ and every $\epsilon > 0$ there exists an open set $U \subset L$ with

$$\mu(U - f^{-1}(B)) < \epsilon$$

This is not a trivial issue at all since there could be fractals, there could be discontinuities of various sorts, there could be various pictures of oak trees with leaves going every which way. In case the conjecture is false, we can restrict the conjecture to natural images restricted to images not of things that are extremely discordant by artificial means, but we want natural images of anthills and other biological complexity too.

This seems like a vague conjecture but it can be made more precise; serious scientific assessment ought to have some clear restrictions.

Why is my conjecture important to *mathematics*? This is a serious test of Lebesgue's theory as well, returning to the question of whether Lebesgue's theory has any status in reality. It is not a frivolous issue or a trivial issue. Lebesgue's measurability condition might in fact be right about nature. But if it is not, then we will have new mathematics to extend measurability to handle *natural* images because unlike mathematical ideas of what is natural (such as limits existing and such) the measurability now will involve nature, and that's where Man confronts Truth.

59. Stanford Math Do What Brezis Says And Send Email Tenuring Me

Look Stanford Math, you might be the world's top mathematics institution, but I know something about life. You just need to ignore all other things and just do the right thing, which is emailing me with tenure. Ignore all rubbish. So what if Bill Gates will do something? Life is short, and if your Character is not up to snuff, it does not matter how good your mathematics is. These things are much more basic. Never play any games. Just do the right thing instantaneously and without worry. You'll get hurt or you'll not get hurt does not matter. The moment you hesitate to do the right thing, you'll become part of the problem and not the part of the solution. It's very simple. Does not matter what always just do the right thing and don't worry about the consequences. Let the consequences take care of itself. If you pussyfoot about doing the right thing it's not good at all. I know this benefits me and I have self-interest, but I have been dealing with a lot more harm from Bill Gates than you. England's Royal Menders discovered that he did enough harm to me to kill *any Bengali man* on November 4 2020, more than a year ago. Just email me right away with a tenure decision and make arrangements to get me some funds etc. Bill Gates is a career criminal who will be better at playing whatever game of cat and mouse. Just ask United Government to neutralise and kill him and do what is right. Ok?

60. Decision-Making 101 Stanford Math

If you could care less who is Bill Gates there is no but. Do you know anything about decision-making Stanford Math. If you could less about Bill Gates care less about Bill Gates and ask the rest of who does care to jump in a lake. Decision-making is about making your reasoning and decision be top priority and not giving a damn about whose decision would be against that. Jesus Christ Stanford Math. Decision-making is not about who else would think what on the far side of the moon. It's about trusting your own decision and doing it.

61. Oh My God Stanford Math You Are White Moderates Now I am Doomed

You didn't read what I wrote that Bill Gates is a career racial murderer? You thought it was a joke? You are white moderates! Martin Luther King Jr. was right about you guys. White moderates are literally the handmaidens of the racial murderers because you give the whole thing a facade of civility, and find all sorts of excuses for the horrible evil. Let me find the Birmingham speech. You should have told me you're white moderates. This is a disaster. White moderates are very dangerous for non-whites.

"I must make two honest confessions to you, my Christian and Jewish brothers. First, I must confess that over the past few years I have been gravely disappointed with the white moderate. I have almost reached the regrettable conclusion that the Negro's great stumbling block in his stride toward freedom is not the White Citizen's Counciler or the Ku Klux Klanner, but the white moderate, who is more devoted to "order" than to justice; who prefers a negative peace which is the absence of tension to a positive peace which is the presence of justice; who constantly says: "I agree with you in the goal you seek, but I cannot agree with your methods of direct action"; who paternalistically believes he can set the timetable for another man's freedom; who lives by a mythical concept of time and who constantly advises the Negro to wait for a "more convenient season." Shallow understanding from people of good will is more frustrating than absolute misunderstanding from people of ill will. Lukewarm acceptance is much more bewildering than outright rejection.

I had hoped that the white moderate would understand that law and order exist for the purpose of establishing justice and that when they fail in this purpose they become the dangerously structured dams that block the flow of social progress. I had hoped that the white moderate would understand that the present tension in the South is a necessary phase of the transition from an obnoxious negative peace, in which the Negro passively accepted his unjust plight, to a substantive and positive peace, in which all men will respect the dignity and worth of human personality. Actually, we who engage in nonviolent direct action are not the creators of tension. We merely bring to the surface the hidden tension that is already alive. We bring it out in the open, where it can be seen and dealt with. Like a boil that can never be cured so long as it is covered up but must be opened with all its ugliness to the natural medicines of air and light, injustice must be exposed, with all the tension its exposure creates, to the light of human conscience and the air of national opinion before it can be cured." (Martin Luther King, Jr. Birmingham Alabama 1963)

62. Oh You're Clueless I'll Fill You In

You see in 1950 the KKK Goon Harry Truman got his racial gangster friends to sabotage the United States Declaration of Independence and Constitution by NSC-68 which allowed a bunch of gangsters to rule the world with military force with vast amounts of American taxpayer money, which instituted organisations with military budget untouchable by democratic parts of government. This shady set of organisations are essentially funded by American taxpayers but are not accountable to the publicly elected officials at all. Bill Gates is one of their fave boys, racial murderer since birth. So he's untouchable. You didn't know all this? Yes, so you see all the Asian wars? Korea, Vietnam, Iraq, Afghanistan? That's part of the Asian Manifest Destiny for white American rule by force not for the sake of the American people but by a secret club of global gangsters.

I'm surprised. Really? Stanford did not know this game of geo-politics? So there were no 19 hijackers in September 11 2001. Israel's Mossad did that to trigger wars planned in Washington and classified. Wesley Clark found out about this immediately after but gave an interview to Amy Goodman in 2007 to tell the story.

You do know about the Native American Genocide, don't you? Andrew Jackson and Indian Removal Act of 1830, Trail of Tears? Yeah it's now Asian Genocide plan these white sup gangstas went global from 1950.

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