

Public Written Comments

Submitted to PCAST

January 6, 2015 to March 18, 2016

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January 8, 2016

Office of Science and Technology Policy, Executive Office of the President

RE: President's Council of Advisors on Science and Technology

Dear Diana Pankevich, Ph.D.

On behalf of the forensic science educators represented by the Council of Forensic Science Educators (COFSE), we wish to express our appreciation for the work of the Office of Science and Technology Policy (OSTP).

We understand that the President's Council of Advisors on Science and Technology (PCAST) working group on forensic science is interested in making recommendations to the President before the end of calendar year 2016. The COFSE believes strongly in an increased federal research agenda to advance forensic science in the United States. We are also aware that PCAST may be highly influential in obtaining the funding necessary to further that agenda. We believe that some of the increased funding for forensic science research should go to university forensic science education programs. These education programs are responsible for preparing the next generation of forensic laboratory examiners. These programs should also have a strong role in forensic science research. Forensic science faculty members are uniquely situated to understand the research needs of the forensic science community. In contrast to forensic science research conducted within forensic science laboratories, forensic science research carried on within forensic science degree programs is more likely to be viewed as disinterested and unbiased. However, at the present time these forensic science degree programs are handicapped by a lack of both resources and faculty. It is virtually impossible for forensic science degree programs to acquire advanced analytical instrumentation on forensic science research grants. It is very difficult under present conditions to pursue a university research career in forensic science. Consequently, at research universities forensic science faculty are regarded as second class citizens with only limited access to university resources. If opportunities for forensic science students to participate in cutting edge forensic science research are not available, they will not be exposed to research and to a research culture. While universities are the primary recipients of federal funds for technology transfer, little of this funding has gone to support forensic science. Given the crucial role that forensic science plays in the criminal justice system, in counterterrorism and in intelligence gathering and analysis, this omission has national security implications.

Walter F. Rowe, PhD
President
Council of Forensic Science Educators

[REDACTED]

From: [REDACTED]
Sent: Sunday, January 10, 2016 5:11 PM
To: [REDACTED] PCAST
Subject: Fwd: Public Comment: Jan 15, 2016 President's Council of Advisors on Science and Technology (PCAST) W

My original email was sent to a stale ostp email address. Please communicate my public comments to the OSTP panel involved in Friday's hearing.

Thanks

Mike Bowers

Hello

I hope this public comment will be forwarded to the proper folks involved with Friday's forensic science podcast.

I want to applaud the OSTP panel for making a commitment to investigate the non-science fallacies and untested assumptions that have been in use for decades by dentists who have considered bitemark patterns to be similar to fingerprint patterns. I was trained in bitemark "matching" by the founding members of the bitemark certifying board, the ABFO. After over 20 years as a member of this small organization, I resigned in 2012 due to the group's leadership who continued to deny the serious methodology defects in their practices that led to wrongful convictions and incarcerations which allowed real perpetrators to escape prosecution. Now that a few certified dentists are still promulgating a "new paradigm" of bitemark analysis, I must caution the OSTP panel that whatever that may be promised, has negligible scientific rigor and will still present unacceptable risks to our judicial system of justice.

>Regards,

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> Mike Bowers DDS JD, Deputy Medical Examiner (Odontology), [REDACTED]

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> Salus populi suprema lex

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> "Public safety is the highest law"

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[REDACTED]

From: Viacheslav Titov [REDACTED]
Sent: Wednesday, January 13, 2016 10:21 AM
To: FN-OSTP-PCAST
Subject: TO THE PRESIDENT OF THE UNITED STATES OF AMERICA (The open letter)
Attachments: TO THE US PRESIDENT AND LEADERS OF THE GLOBAL NATION.doc

Dear Sirs,

I believe that my letter contains the science-technological decoding of that we call our American Dream.

Sincere
Viacheslav Titov, colonel

[REDACTED]
[REDACTED]
[REDACTED] m

TO THE PRESIDENT OF THE UNITED STATES OF AMERICA
AND LEADERS OF THE NATION (The open letter)

Dear Mr. President,

As the President of the great country you're blessed for a leadership on a way to the World that should be more humanistic, intelligent, tolerant, safe and harmonically balanced. However there is the just one link that could bring all of that hope. And just this critically important constructive link is still socially not recognized causing all of around crises and collapses indeed. Meanwhile its science foundations and pragmatic formula are shown with the science approaches of the beginning of 20-th century and the Nature phenomenon cogently. And the nuclear chains energy is just a poorest issue of that supposed complete view.

This link is the Adequately-Complete Autonomic Control for each person, the country and the Global community. It gives another living way that allowing to avoid collapses. This is the place where a science-technology stumbled on 50-60-th years because all of deterministic-stochastic, adaptive and robotic control systems around are actually a priory linear-limited while the real world of the living Nature is open and absolutely unique in each of its certain body. The Adequately-Complete Autonomic Control operates both with the Watt-Lyapunov-Wiener control automata invariants and a system body the Main System Invariant giving to a living subject a compact resolving and so a complete-regenerative Prospect.

I'll show the Adequately-Complete Autonomic Control Solution (AACS), its definitions, structure and processes functions and the whole paradigm outlines. This is the constructive world view and the way of an intellectual consolidation to bring a Liberty that is personally secured with all of technological power. This is a pragmatic matter for each person everyday living. And this is the matter for talented scientists, constructors and a great Manager of the certain construction of the new coming Era of the Completeness. I propose to move from the way of contemporary dramatic science-technology surrogates to the complete anthropocentric science and social-technology full-scale secured humanitarian living.

I propose:

1. To get seen that each person and global surviving the Adequately-Complete Autonomic Control actually means a fundamental and applied regeneration. Otherwise everything else will get collapsed in principle.
2. To follow that technological way of the complete-rational Sense
3. To Lead by starting a center of that main humanitarian resolving idea and its technology construction.

I have enough scientifically correct reasons to show that constructive AACS procedures, which will set a superstructure of a complete control on a bottom and a top all of existing processing technologies. Let's get remembered how PC nets and database technology changed the world just for couple tens years. The adequately-complete control technology, that I'm talking about, have much more powerful potential because leads all of other processing technologies in principle. It could break into our life suddenly with the lightning speed. Let's lead this process.

The AACS is under- and interdisciplinary system solution that reveals a living substance and its consciousness processing description constructively. A living process and its consciousness is such that is able to recognize and lead its individually personal system substance (that is the root of a H. Haken's "synergy"). That recognition procedure gives the physics and the chemistry that we know just in rough periodical non-complete and contradictive class-logic generalizations now. Meanwhile each living substance appearance is lighten with its body process and every its particle, molecular and molecular complex has instant and subjective specifics. The AACS defines the Specific Substance Synthesis Control (SSSC). All of living substance and its consciousness recognize own specific substance in process of SSSC. And that is a living and that is only thing that differs a "living" and a "non-living" substance. That is the main living Nature "secret". This is that the Main, what we MUST know to lead our own life. The SSSC gives the way that supposes a physical harmony, regeneration and endless resources.

Look at the living Nature. Just one very popular now sample. A small creature *Turritopsis dohrnii* never dies becoming older and getting back to the yang age endless (https://www.youtube.com/watch?v=PFLSqvFO_Aw). It turns from a mature state to polyps stage permanently. In base of this biological process is a procedure that I've called, a Specific Substance Matrix (SSM) substitution.

Look at our body skin that having a unique drawing. Also an Iris had an unique drawing. However that are just external appearances of the main living substance law: all of living structures, including biochemical molecules, has its own specific "SSM-drawing" and I know the main principle how to identify it, to measure it and to reproduce it. This is neither biophysics nor biochemistry or microbiology. This is autonomic control science solution that goes in its principle further rather N. Wiener universalism to the complete autonomic system control self-regeneration. Physics-chemistry particles and molecules are not "cut out" from the Universe. Each of them belong to a certain space-time instance and we should know its specific if we want to get an adequately-complete management.

Lets consider samples. How that would work right now if it's going e.g. about an aging reversible, cancer or AIDS matrix-shunting complete treatment?

Let's imagine a person, who wanted to owe his/her Specific Substance Matrix for purpose of an aging, cancer and AIDS etc. prophylactics or a restoration in case of deadly accident. At-first it will order usual now DNA cluster biophysics measurements. Such measurements will give just roughly generalized results. It will look as a pictures of ancient naive painters on rocks. But a really great artist would put its first outlines and benchmarks on canvas then will paint a masterpiece according to all of its knowledge and feelings of a Harmony. The SSM gives a view of a complete assembling plan of an individual body harmony, its individual space, time and transformations plan.

Look at a body cell mitosis process. A dividing cell breaks its chromosome set order then its centrioles and centromiers gives benchmarks of a new space chromosome position (SSM) and as result doubled body cells gets a resource of an adequacy to live further. These are that measurements of space-time features. They are differ from a *Turritopsis dohrnii* endless immortal control circle just because are involved in an organism evolutionary growing. That growing gives a consciousness of a diverse world that are put in statistic generalizations. However the both of living process organizing could be switched into to the complete SSM platform.

To get that personal SSM DNA cluster the mentioned measurements will be put into two parallel processes. One of them I've called The Synthesis Data Compressing (SDC). It will be processed algorithmically in computing machines sort of Blue Gene computer. According to the Main Invariant algorithm that DNA cluster sample will be fulfilled and corrected stereometrically to get a static Specific Substance Matrix benchmarks (I know this algorithm resolving principle). As result it will be taken a hyper surface of the individual body substance space proportions. That is individual "melting mold" to synthesize an individually harmonic agents and influences. To make things more clear let's mention Fibonacci proportions. Everybody knows that entire our body, arts and any architecture construction is subordinated to the Fibonacci proportions. However that is just a part of the top of SSM. Having an entire SSM benchmarks we'll have an individual synthesis medicine with exact individual diagnostics and corrections. This is the fundamental breakthrough that could be done for 2-3 years of proper efforts. I know their plan.

However the whole SSM includes an Individual Collinear Time (ICT) measurements. A living process belongs to open medium where space and time get their relations permanently. This features can't be completely predictable so they can't be situational algorithmised. They could be just measured as part of The Information Synthesis process (ISP). Such measurements is going in the physical processor of the non-Von Newman type that I called the Information Reactor (IR). This device has two parts. One of them accumulates an organism knowledge and compresses them into a compact an organism Projective Nuclear according to its SSM geodesics. The second part deploys that nuclear in time cycles finding resonating points spectrums and its projective differentials that gives an information. Information points on control corrections that bit an entropy keeping harmony cycling self-control stable. In other words an information is an actualized in time-space specifics knowledge about a system instant control procedure. This is the basic informational adequate autonomic control that sets a nuclear of the Autonomic Consciousness.

The Information reactor gives the Complete SSM plan. It shows a current or an alternative an organism process synchronizing. It's a required component especially where it's going about a total collapsing disorder including a reanimation case where it's needed to give the whole system synchronization.

I discussed that IR-construction with IBM Corp. distinguished engineer Sam Adams. I have understanding how that Information Reactor could give a platform and channels to keep the Collinear Individual Consciousness Nuclear (CICN). Actually the CICN is permanently working personal organism "gyroscope" that could be discretely linked with a body cluster-processing to keep the living important specific associations. In the mode of direct communication the real organism consciousness and its Nuclear set a difference between them as twins and they exchange with their benchmarks and control reflections frames.

This is the instrument for the synthesis-regenerating cancer, Aids, autoimmune, bacteria/viral/fungus and psychic problem treatment harmonically and radically. This is the instrument of the complete regenerative medicine with its personal secure channels and cluster proceedings.

That is the just a sample and a common view. I can give conceptual technique and technological solutions of the whole Completeness Era paradigm. Such kind of a plan outlines should be placed in foundation of society to get a good chance. Check another plan of such a construction if it gives the whole scale system regeneration solution because the human time is going down its critical line.

The AASC-way will give to each person a real adequate consumption, resources, a labor input and exchanging according to the Sense of a living processing. Finally it will give to the country and the World a management that would be based on the Sense and its Adequate criteria, which will exclude aggressions, conflicts and catastrophes.

Sometimes it's very hard to imagine how some of kind of "drawing" could influent e.g. on rudiments of star thermonuclear processes, the Earth nuclear magma, earthquakes, tornado etc. The matter is, that following to the law of the less resistance, a brain usually substitutes that universal control sense with different mystics surrogates and symbols. However there are very clear facts. Let's pay attention that each body cell contains of myriads particles, the whole "galactic" and "cosmos" and where is "an up" and were is "a bottom" depends from our living instrumental vision. And the physics substance is not particles, cosmic objects, fields and waves indeed. The physic substance is a control hamonical subject-collinear agreement relatively to the invariant living order. This order is the Main Physic Invariant that gives objective physic reality and its particles, fields as just projections. That is not a philosophy any more. Today people tries to reach far distant space planets by burning an energy structured Earth substance and so destroying the Earth stability. And this is barbarian mistake because we need to see why maximum energy are revealed on the poles of periodic chemical elements system of the most easy and most heavy substance. We need to see why a complex organic structured is linearized in burning giving a propulsion. Obviously there is the way of a harmonically sliding energies that cut that rough energy substance resistance. A superconductivity is the sample of a such but a degenerate structuring. Catalysts and enzymes give another sample of a structure organizing interaction. Still criticized homeopathy also shows the real facts about "a similar is treated by a similar" ("Contraria contrariis curantur"). We can see and control a diversity adequately.

The Information Reactor "lens" will give the instrument to see the whole world system with its continuous-discrete fulfillments between different separate projection. There particular physics masses, energies and time are agreed in tunnels that are open for a "sliding" down the regeneration process.

Many people will discuss ethics and faith aspects. There are clear answers there. The complete harmonic control is actually an organismic control in manner of a body cell cooperation. Being under entire an organism supervising they could be put in way either of an evolution or an adequate regeneration. A cancer e.g. is the process of losing SSM adequacy. It looks like a train with a good known and cared engine takes a wrong rail road that leads to a collapse. A Turritopsis dohrnii constantly renewing that "road map". A human body cell also could get the renewing SSM stem cell platform. Socially that way conceptually rejects conflicts of resources in favor a cooperation in that open endless world. Each participant of this process would be precious and functional in that partnership.

Speaking according to the God conception so namely God created living process and its consciousness process. Logically Almighty God as Creator could not create a collapse and a grief if not for motivation to get his Plan completely. And God does not need to be a judge or an owner to give mercy or punish just as people do that in their primitive practice. The Creator's Aim is to create everything harmonically as he is. The human being has freedom of realizing and making choice. Lets see upper Sense of that intuitive categories. The human category of a paradise means actually adjusting to the God done complete technology living. The Turritopsis dohrnii has its "Paradise" each time after changed its SSM matrix. A human

being is created to be not dumber and unhappier than jelly fish being able to keep its consciousness down such transformations. Let's recognize and follow to a God plan of a living even that is not easy. This is our real very hard trial and we're responsible ourselves for a prize we have finally.

Let's look into the history depth. Ancient people treated the Earth like a plain surface because they used a linear tools to measure their fields. Optics and a propulsion gave the impression about cosmos and micro- world wave-desecrate systems. However the Universe is solid with diversity that breaks into substance ranks with spectrums of harmonic alternatives just subjectively. It's proved by math contradictory from "nowhere appeared sets" (D. Hilbert formalism). The IS-technology would give to humanity a "lens of a reality" where it could get a Completeness.

I perfectly realize that all I reported above is just a constructive venture hypotheses. However, in difference to the Tommaso Campanella "City of the Sun" utopia, my plan is built on constructive resolving procedures. Sure I could be mistaken even though I can refer on a number institutes and organizations that gave positive responses on this approach. Among them were The Institute of Applied Mathematics, The Institute of Experimental Pathology, Oncology and Radiobiology, The Science-Production "Quanta" Corp. Even though all of them were mistaken the Nature can't be mistaken showing that direction where the science-technology and manager elite should concentrate their main efforts. The mentioned immortal *Turritopsis dohrnii* is not the only one on the Earth that shows the way of a regenerative life. Organs, body cell and organism regeneration and metamorphosis is wide spread and has their conceptual processing solution. A homo sapiens could be not dumber than *Turritopsis dohrnii* in case it will dare to work onto that right direction fundamentally.

But now I see a sad picture around. The really fast growing technical potential gives great possibilities and simultaneously it brings just much more crashing threatens as a final result. The best world management gives just a cosmetic patches. I don't see any science-social conception that is able to move people from that way of "a grief and grave stones" medical and other social services. The huge social machine generates just huge helpless dynamics. I'm very sorry to mention a big Manager Steve Jobs that made his choice developing so great but just servicing technologies. And that were not enough to help him in his tragedy. That is the tragedy of the whole old paradigm and choices that it gives. These things could and should be changed.

Mr. President I think you'll agree with me that a real Leader does not speculate with categories of a mass consummation. It sees and rules real human challenges behind a Horizon. It's time for the next level of the highest priorities and an adequate thinking. The elites and resources, all of that global nets and gigantic data centers, productions and administrations should work to give each of person a good chance to live according to the complete resolving constructive plan....

The plan is outlined above. Details could be attached. This is the Challenge. This is the Program for a really Party of the Progress and Prosperity that would be able to unite that people World, countries and nations by giving the great universal constructive Sense to all of cultures and symbols. It should be just refuted or taken as the subject for Actions because that is the time Challenge.

Mister Leader of the Great American Nation of the Brave Pioneers, lead the world to the Completeness Era! Its reality is on a distance orie one step forward indeed.

Respectfully,

Viacheslav Titov

North Carolina, USA
[REDACTED]

From: Daniel Fink
To: [REDACTED]
Cc: [REDACTED]
Subject: PREVENTION OF NOISE INDUCED HEARING LOSS: AN ANALOGY USING DENTURES
Date: Sunday, January 17, 2016 9:04:44 AM

Dr. Ikeda, Dr. Frieden, Dr. Murthy, Dr. Battey, Dr. Holdren:

As public health experts and indeed our nation's public health and scientific leaders, you all know that prevention of disease and injury is better and invariably less expensive than treatment, which in turn is better and less expensive than rehabilitation.

These principles apply to noise induced hearing loss as well.

As I shared with at least some of you, I recently had the insight that most people don't worry as much as they should about their hearing because they think that auditory difficulty in old age is part of the normal aging process. This idea is even enshrined in language used by the hearing professions (ENT physicians, audiologists, speech pathologists), the two terms "presbycusis" and "age-related hearing loss", which I hope you will lead in eliminating from common usage. These should be replaced by the more scientifically accurate terms "sociocusis" and "noise induced hearing loss". Severe hearing loss is not part of the normal physiologic aging process. Studies of auditory acuity in primitive populations show preservation of auditory acuity well into old age.

Most Americans think that they will need eyeglasses for their eyes and hearing aids for their ears when they get older, and they think that's just fine or if not fine, there is nothing they can do about either. They probably don't know that noise induced hearing loss, which accounts for approximately 90% of hearing loss in older people, is entirely preventable by avoiding exposure to loud noise. They don't understand that hearing aids are an imperfect technology and do not work as well as patients or hearing health professionals would like. They haven't noticed that physicians talk about an optical correction, accurately implying that myopia and hyperopia especially (less successfully with presbyopia, based on personal experience!) can be corrected perfectly, but do not talk about an auditory correction in regard to hearing aids. Unless they have an older relative or friend who has purchased hearing aids, they probably don't know how expensive these are or that they are not covered by Medicare or most insurance programs.

I have been unable to find studies of the "effectiveness" of hearing aids in the general population- e.g., if 100 average people with hearing loss of 25-40 decibels (dB) bilaterally are given hearing aids, prescribed and fitted by practitioners of average ability (i.e., not carefully selected, highly motivated patients, in a research setting, treated by specialists in an academic medical center) how many of them report that they are able to understand conversations in quiet environments, and then noisy environments- but every primary care practitioner has had the experience of the patient finally getting the hearing aids (whether by proving the service connection in the Veterans Administration setting, or finally deciding to spend \$5-6,000 to purchase them) and then coming into the office with the hearing aids in pocket or purse. When asked, "Why aren't you wearing your hearing aids?", the patient invariably replies, "Doc, I can hear things that I couldn't hear before- in fact, everything is too loud sometimes!- but I still can't understand what people are saying."

I had a further insight, and another useful analogy, about hearing aids, suggested to me by Gina Briggs JD, founder of the website www.silencity.com in New York City. When she was growing up in the 1960s, and a decade earlier when I was growing up in the 1950s, being edentulous in old age was “normal.” My grandmother and my Uncle Ben both had complete dentures. In the 1950s, approximately half of all Americans were completely edentulous by age 60 or 65. (It is hard to find accurate statistics and reports about dental issues, just as it is difficult to find information about auditory health issues. I have listed some links to statistics on tooth loss at the bottom of this email. I think this is because people don’t die from dental health issues (dental caries, gum disease, or being edentulous) just as they don’t die from auditory issues (hearing loss, tinnitus, hyperacusis. For comparison, I added a link to a site from the Centers for Disease Control reporting breast cancer statistics. These are much more accurate). Now, thanks to better dental care (including both advances in dental science, such as the recognition that regular prophylactic cleanings prevent tooth loss and better endodontic techniques, as well as dental insurance which made these services more available), only about 10- 20% of older Americans are edentulous. In addition, studies show dramatic differences which must be related to dental care and socioeconomic conditions, in the prevalence of edentulousness from state to state. Here in California, only 13% of the population is edentulous. In West Virginia, the prevalence is 46%. (This statistic is from a CDC report that I saw last week but could not find this morning.) The reduction in edentulousness from a 50% prevalence to 10% or 20% ranks as another great public health success of the last part of the twentieth century. Again, being edentulous and needing dentures is NOT part of normal aging.

And neither is being deaf in old age! I hope that in 50 years, a reduction in the prevalence of noise induced hearing loss will be looked upon as one of the great public health successes of the first part of the twenty first century. Unfortunately, I am concerned that the as yet unrecognized epidemic of hearing loss, which has alarmingly spread to the young (see [Change in Prevalence of Hearing Loss in US ... - JAMA](#)), means that the prevalence of hearing loss will probably increase and will be found at an earlier age.

And of course, as Ms. Briggs pointed out to me, dentures are a poor substitute for natural teeth, the same way that hearing (especially speech comprehension) with hearing aids is a poor substitute for normal auditory acuity.

I again urge you to take prompt and vigorous action both to educate the American public that NOISE CAUSES DEAFNESS, and to propose steps to make the United States a quieter place.

The only safe noise exposure level I have found is 70 dB for an average daily noise exposure. (see Appendix C in the 1974 Environmental Protection Agency (EPA) report ([Information on Levels of Environmental Noise Requisite to ...](#)). The 85 dB occupational noise exposure level ([Criteria for a Recommended Standard: Occupational Noise ...](#)) which is commonly used as a safe noise exposure level by manufacturers of “safe” headphones marketed for children and teens (see for example <http://purosound.com/>) or the audiology community (see for example [Noise - American Speech-Language-Hearing Association](#) or [Audiology Information Series: Noise and Apps - American ...](#) among many other examples available online) is an occupational noise exposure level, for an 8 hour work day, over a 40 year career. This is not a safe standard for the general public, exposed to noise 24 hours a day, 365 days a year, for a lifetime (average life span 78 years).

As I have noted before, online information provided by the National Institute on Deafness and Other Communication Disorders (see [Hearing, Ear Infections, and Deafness](#)) also mentions the 85 dB noise exposure level. I know this does not actually state that 85 dB, without a time

limit for the exposure, is a safe noise exposure level, but this is what the manufacturers of “safe” headphones, the audiology community, and others (see the sidebar in http://www.nytimes.com/2015/10/18/magazine/letter-of-recommendation-macks-earplugs.html?_r=0) interpret these statements to mean. I again urge that the information provided by the federal government and public health authorities emphasize that 85 dB is an occupational noise exposure standard and that the much quieter 70 dB average noise exposure level is the only noise level calculated to be safe for human hearing.

There are many steps that can be recommended to make the United States a quieter place. Of note, a National Academy of Engineering report (Technology for a Quieter America [Technology for a Quieter America | The National Academies ...](#)) already exists, but the many recommendations in this report have not been implemented. I personally would like to see the following steps:

1. Development of an indoor noise standard by the Acoustical Society of America, similar to ANSI/ASA Standard 12.60, for “places of public accommodation” within the definition of Title III of the Americans with Disabilities Act (see [42 US Code § 12181 - Definitions - Legal Information Institute](#))
2. Recognition of auditory disabilities and requirements for a quieter environment as a reasonable accommodation for these disabilities, by the United States Access Board (see [United States Access Board: Home](#))
3. Federal requirements for quiet indoor and outdoor environments. (Existing federal law is still in force concerning noise issues, specifically the Noise Control Act of 1972 and the Quiet Communities Act of 1978 but these laws do not specify a safe noise exposure level for the public, especially in indoor places.)
4. If federal noise standards for quiet indoor and outdoor environments are too much to ask for, perhaps a noise labeling or noise warning program, similar to the Prop. 65 program here in California. (see <http://oehha.ca.gov/prop65/background/p65plain.html>). This law, sponsored by public health professionals and others and passed into law by the public, requires posting of warning signs if the public is to be exposed to chemicals which may cause cancer. Similarly, a noise warning sign could be required for noisy environments. The text of the warning sign could read:

NOISE WARNING
THIS FACILITY ALLOWS NOISE LEVELS
LOUD ENOUGH TO CAUSE DEAFNESS

The cost of implementing such a proposal would be minimal- noise levels could be measured by smart phone sound meter apps which are available for free or low cost (up to \$19.99) (see [So How Accurate Are These Smartphone Sound ...](#)) and then the minimal costs of purchasing and installing the warning signs. Providing information to the public and then allowing the public to make its own best choices is something favored by conservative economists and others, and posting the warning signs would fit with this model of information rather than regulation.

5. Increased federal research funding on noise and hearing issues, including basic

epidemiologic research on the incidence and prevalence of auditory disorders (as best as I can tell there are no longitudinal studies of auditory acuity in a large population over time, only the cross sectional studies such as in NHANES); basic mechanisms and research on regenerating cochlear hair cells (chicks can do this, mammals cannot); clinical research on the treatment of hearing loss, tinnitus, and hyperacusis; and funding for public education programs, perhaps in conjunction with non-profit organizations working in the hearing health and noise areas, about the dangers of noise.

I again urge you to speak out on noise issues. By copy of this email, I am asking my Congressional representative, Rep. Ted Lieu (D-CA), who is a co-sponsor of the Quiet Communities Act of 2015 (see [Quiet Communities Act of 2015 - Congress.gov](http://www.congress.gov/quiet-communities-act-of-2015)) follow up on my four suggestions, especially on #4, the idea of noise warning signs being required for noisy places of public accommodation, and #5, increased research and education funding.

Sincerely,

Daniel



REFERENCES

1962 CDC report on tooth loss: about half of people over 65 were edentulous
>http://www.cdc.gov/nchs/data/series/sr_11/sr11_027acc.pdf<

CDC stats tooth loss a poverty issue 1/3 or adults age 65-74 below poverty level are edentulous, 13% of adults this age range above poverty level
><http://www.cdc.gov/nchs/data/databriefs/db104.htm><#x2013;2010

CDC stats 20% of adults above 65 are edentulous
><http://www.cdc.gov/nchs/data/databriefs/db197.htm><

about 10% of the US population used dentures ><http://www.statista.com/statistics/275484/us-households-usage-of-dentures/><

prosthodontist professional association also uses 10% figure
><http://www.gotoapro.org/news/facts--figures/><

breast cancer rates by state [CDC - Breast Cancer Rates by State](http://www.cdc.gov/cancer/breast/breast-cancer-rates-by-state)

[REDACTED]

From: Lloyd Etheredge [REDACTED]
Sent: Tuesday, January 26, 2016 4:03 PM
To: [REDACTED]
Subject: PCAST, Scientific Trust, and Marcia McNutt's Unsupportable Candidacy
Attachments: 2016.0121.spj-code-of-ethics-poster.pdf; 2016.0112.ScienceandJournalisticEthics.pdf; 2015.1120.Case forOptimism.RapidLearningEconomics.pdf

Dear PCAST Co-Chairs, Vice-Chairs, and Members:

In the context of achieving higher journalistic ethics by Team Players in the Washington science Establishment, and a better self-correcting system, I enclose a discussion for the National Academy of Sciences and AAAS, and a copy of the Code of Ethics of the Society of Professional Journalists, for your review. The ethically accommodating Editor-in-Chief of Science, Marcia McNutt, may become the new President of the National Academy of Sciences. Members of PCAST who are members of the National Academy of Sciences may want to review these issues as individuals. The integrity and trustworthiness of science itself should be the first societal obligation of scientists.

By now, NSF's egregious breakdowns are the accountability of an NSF Director and National Science Board members appointed by President Obama. . . . In light of their performance, there have been serious mistakes of judgment by President Obama and his scientific advisers in some of these selections. I see no evidence that President Obama has been briefed by John Holdren about these institutional breakdowns or system-level designs restraining the improvement of economic science. Or that President Obama understands that improving the reliability of economic science is not difficult. There is wide professional agreement about several types of missing variables. We have good ideas about how to find them. This is not a scientific problem. I know of no scientist who disagrees with the argument in "The Optimistic Case for Rapid Learning Economics." The application of scientific method - up to the level of the rapid learning system for the biomedical sciences - really does work.

Please, you should tell him.

Lloyd Etheredge

[REDACTED]

Subject: Marcia McNutt's Unsupportable Candidacy: Perceptions of Compromised Journalistic Integrity; Professional Journalism Code of Ethics
Date: Tue, 26 Jan 2016 09:23:11 -0500

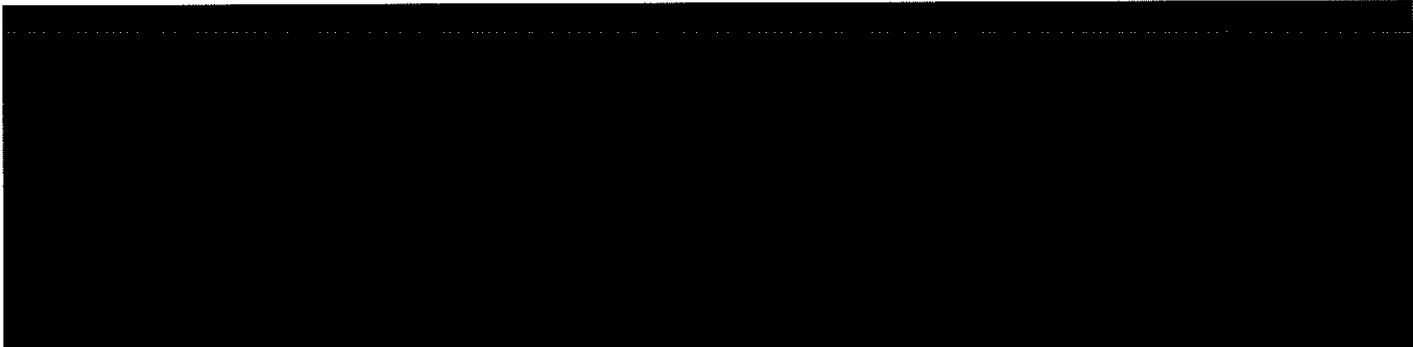
Dear President Cicerone and NAS Governing Board Members:

Concerning my perception of selectively compromised standards of journalistic ethics (as Editor-in-Chief of Science) by Dr. Marcia McNutt, and her candidacy to be President of the U.S. National Academy of Science, I bring the enclosed discussions for the AAAS Council to your attention.

She is not a supportable candidate. Nobody would confirm a Justice to the Supreme Court with her history of ethical accommodation.

With her superiors Alan Leshner (and Geraldine Richmond) as members of the National Science Board, Dr. McNutt has covered-up extraordinary problems (discussed below and in the attachment). The American people, **and billions of people worldwide**, still are being injured by unreliable economic science (and an unreliable NSF system) when it is not difficult to improve the reliability of macro-economic models. There is professional agreement about several kinds of missing variables and we have good ideas about where to find them. When Science begins to fulfill its ethical (SPJ Code) obligation to be a trustworthy watchdog of government, an entire system will begin to work and there will be a brighter future.

Lloyd Etheredge



January 24, 2015

Dear Chairman Fink, President Richmond, CEO Holt and AAAS Executive Board and Council Members:

In support of the case for AAAS to establish a professional code of journalistic ethics for Science + Boston Globe decision rules for investigative journalism, I attach a reference copy of the Code of Ethics of the Society of Professional Journalists. These are the kind of high standards that I believe our members want and will support. <1>

AAAS: The National Benefit of the Highest Ethical Standards

The SPJ ethics code embodies wisdom. As the AAAS CEO and Publisher of Science, Alan Leshner also served for almost twelve years as a member of the National Science Board with accountability for NSF policies. AAAS President Geraldine Richmond now crosses the same ethical line for operating journalistic enterprises. In both cases, they create a conflict of interest, duress, and the requirement that an Editor-in-Chief of Science and professional staff accept compromised journalistic ethics as a condition of employment. Leshner and Richmond have enjoyed free rides as public officials, with no information about their votes, positions, possible errors of judgment or job performance reported by Science. These institutions also have been shielded. Instead of **"a special obligation to serve as watchdogs over public affairs and government,"** Science adopts policies of silence and accommodates its NSF journalism to be a subordinate, lower status, Team Player.

AAAS members - instead of being served by Science - have paid a high cost (and so has the country). During the twelve years of Leshner's membership, NSF's growing budget attracted the attention of new actors skilled at sophistry and bank robbery. The news was manipulated so that the nation's scientists lost the guarantee of Scientific Merit and government-/politics-independent peer juries. NSF itself has become the principal cause of unreliable and untrustworthy economic science, with its mangled program, political restrictions, over-ridden Scientific Merit advice, stunning incompetence for the task, and deeply unsuitable personnel at the highest levels of NSF. Americans and billions of people worldwide continue to suffer from NSF's unreliable science [that would not be difficult to improve] without insight into why such unbelievable institutional and scientific problems have not been corrected at the NSB level of Alan Leshner and Geraldine Richmond et al.
<2>

Protecting the New AAAS Editor-in-Chief

It is in almost everyone's best interest that the successor to Editor-in-Chief Marcia McNutt should be protected from having to make these quiet and compromising choices of journalistic ethics and integrity. And that, before accepting an offer, a new Editor-in-Chief should be fully informed about the culture of Team Player accommodation and other problems of Science. I hope that candidates will be firm about securing prior AAAS agreement and support for (SPJ-level) professional ethics with a mandate to be a vigorous, independent, watchdog of powerful scientific institutions and (beginning at the top) the Washington science Establishment. In light of her complicity in moral, scientific, and legal erosions that are to be investigated, and her stonewalling, my view is that AAAS should secure the resignation of Geraldine Richmond [a member of the National Science Board for several years] from her conflicting role as AAAS Board Chair prior to making any offer.

Many of the our nation's (and world's) most challenging problems (unreliable economic science; ideological polarization and mistrust of science; and a history of three unwinnable, trillion dollar wars with the same scenario (and beginning a fourth) are areas politically locked-down by the National Science Foundation and NSB. We must have Science as an ally.

Thank you for your attention to these issues.

Yours truly,
Lloyd Etheredge

<1> In some places, AAAS might want to strengthen the Code. For example: "**Be vigilant and courageous about holding those with power accountable**" and "**Recognize a special obligation to serve as watchdogs over public affairs and government**" could be strengthened to underscore new expectations for **the integrity and trustworthiness of science** and for vigilance and courage to hold **government scientific agencies and their leaders** accountable.

<2> My "The Optimistic Case for Rapid Learning Economics" outlines this case. Actually, there is widespread agreement about several types of missing variables and we have good ideas about where to look for them. It's not a difficult problem. The barriers to reliable economic science aren't scientific.

Dr. Lloyd S. Etheredge, Project Director
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[REDACTED] URL ><http://www.policyscience.net><

The Policy Sciences Center is a public foundation that creates and develops knowledge and practice to advance human dignity.

It was founded in 1948 in New Haven, CT by Harold Lasswell, Myres McDougal, and George Dession, members of the Yale

faculty. Information about the Center, the Society of Policy Scientists and the Policy Sciences journal is available at

>www.policyscience.org<.

November 19, 2015

To: Interested Colleagues

From: Lloyd Etheredge¹

Re: **The Optimistic Case for Rapid Learning Economics**

This memorandum outlines, from three perspectives, an optimistic scientific case that a rapid learning system for macroeconomics is possible. Such an achievement, by using the best scientific methods, is likely to provide a better future for billions of people. The three perspectives are: 1.) The existence of “upgrade” variables, widely acknowledged by the profession; 2.) The existence of competing theories that will produce scientific learning about important challenges as new data systems allow them to be tested; 3.) The existence of improved scientific methods for data analysis and fast machine-assisted learning, developed by NIH and the biomedical sciences, that can yield rapid discoveries for US and other G-20 economies.

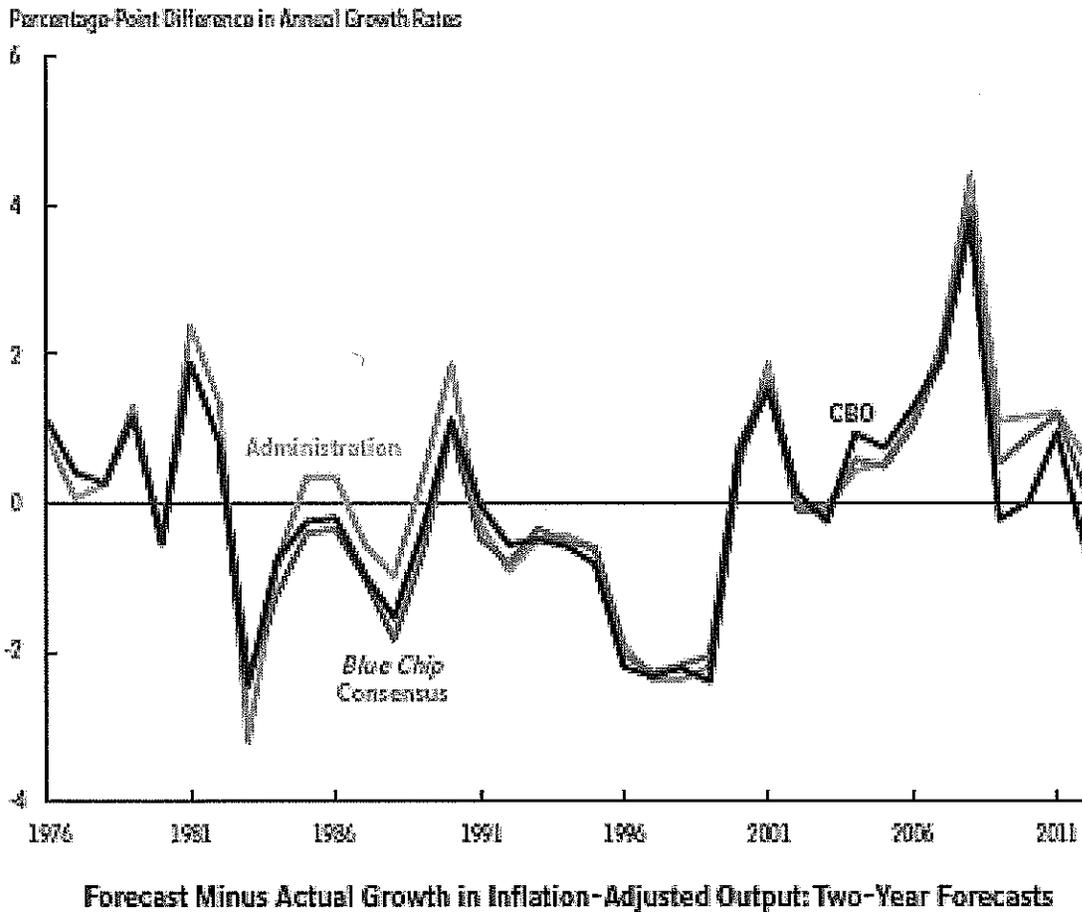
I. Missing “upgrade” variables acknowledged by professionals

The following graph compares the two-year GDP forecasting errors of the Congressional Budget Office, Administration, and about 50 private sector “Blue Chip” models since 1976.² They closely track one another. This is a highly competitive business. Almost everybody uses the same government data, traditional

¹ Director, Government Learning Project, Policy Sciences Center, Inc., a public foundation. URL: www.policyscience.net; [REDACTED].

² Congressional Budget Office, [CBO's Economic Forecasting Record: 2015 Update](#) (Washington, DC: Congressional Budget Office, February 2015). Online. Comparing Federal Reserve two-year forecasts produces similar results.

Table 1



Source: Congressional Budget Office, CBO's Economic Forecasting Record, 2015 Update, (Washington, DC: Congressional Budget Office, February 2015), p. 16. The Blue Chip Consensus is based on about 50 private forecasting models.

conceptual frameworks, and linear regression analysis of quarterly time series data. We should not wait for further progress from the current data system.³

³ The average (root mean square) forecasting error of 1.8, compared to an actual growth rate that might be 3.0, is large for scientific models in most fields, perhaps another reason to be optimistic.

There is professional agreement that there are several types of missing variables:

1.) The “mystery” variables that cause recessions/collapses and recoveries are missing: as CBO reports, forecasting equations miss "turning points";⁴

2.) By design, the predictable nonrational psychological mechanisms and societal forces (discovered by the other social sciences) that might affect economic behavior are missing. [Macroeconomic forecasting uses aggregate variables defined by accountants and the tax code; the coefficients are (without independent verification) *interpreted* as rational choices, although they might be compounds of several individual cognitive processes and emotions or organizational or cultural characteristics;

3.) New structural or systemic changes in the world – e.g., information age technologies and technologies (plus other factors) that change oil prices, sociological/cultural changes, and a globalizing economy - are missing. The analysis of standard quarterly time series data, with coefficients averaged across history, slows learning, limits reliability, and this also (as we will see below, in Larry Summers’s argument) might be dangerous.

Other recognized limitations and upgrade opportunities might be discussed. However, for current purposes, this inventory makes the point: The message is

⁴ *Op cit.*, pp. 7-11.

optimistic. Although nobody can know the results of new scientific research in advance, there already is broad professional agreement about several types of plausible variables for a To Do list and scientific upgrade.

II. Competing Theories and Policy Disagreements to Establish Initial Priorities

The second perspective that gives optimism for rapid learning is that there already are well-structured disagreements, with policy relevant implications, that can be tested quickly to improve economic science in the US and other G-20 nations. For example, here are five controversies:

A. "The Global Economy is in Serious Danger."

The attached Op Ed piece (last month) by former Harvard President and former Treasury Secretary Larry Summers, "The Global Economy is in Serious Danger," argues that there have been fundamental global changes.⁵ The coefficients have changed and there are new variables. Thus, it is dangerous to use conventional economic models and rely upon current economic science. The global economic recovery (that already has taken twice as long as estimated by conventional equations) will take much longer and the future could be surprisingly worse than we expect. [This argument requires that missing variables be identified, coefficients re-estimated, and deeper causes of changed coefficients (if they are found) be understood – and much sooner than the analysis of historical time series can achieve].

⁵ Larry Summers, "The Global Economy is in Serious Danger," Washington Post, October 7, 2015.

B.) Economic science doesn't need further learning. Governments only need to listen to economists.

The attached Op Ed piece (earlier this month) by Nobelist Paul Krugman, "Austerity's Grim Legacy," argues that there are no missing variables of consequence.⁶ Economic recovery has been delayed, in the US and abroad, simply because governments stopped listening to the equations and sound policy advice.

This is a challenging counter-factual argument. A task for Krugman's thesis is to explain apparently unreliable equations that scared people. G-20 governments listened when the crisis began but, after initial success, the fiscal stimulus policies also faltered in their prediction of recovery. Economic forecasters had no reliable estimates of how much time and money would be required to achieve the turning point. If we should renew the large fiscal stimulus solutions, can there be rapid learning to address the risk of new failure + massive national debts without achieving healthy growth?

C.) Linear equation models are giving the wrong result.

"How reliable are these tools? They work, but they don't work great. People and institutions find ways around them." - Olivier Blanchard⁷

The International Monetary Fund's former Chief Economist, Olivier Blanchard, implies that global economic science can become more realistic by upgrading from physics-like linear regression forecasting models to game-theoretic models.

⁶ The New York Times, November 6, 2015. Online.

⁷ Cited in Lloyd S. Etheredge, "A Rapid Learning System for G-20 Macroeconomics: From Greenspan to Shiller and Big Data." Unpublished, online at www.policyscience.net at I. A., p. 29.

Today, smarter people, with growing asymmetries of brainpower and funds for lobbying, can outsmart many national governments. The force of his argument is backed by IMF data (not widely known to the public) that the world, from the late 1970s to 2003, had 117 banking crises in 93 countries in which much or all of the banking capital was exhausted. Many financial institutions developed strategies for privatizing the gains (during the upside of the bubbles) then secured government bailouts during the crisis phase. In 27 of the cases, they dumped onto governments and taxpayers added national debt equal to 10% of GDP, often much more.⁸ This is not Tulipmania anymore. The problems are not “irrational exuberance” of mass investors but brilliant strategies by alpha predators who can penetrate political systems and shape policy, a phenomenon hidden by missing variables and averaged-coefficient equations.

The better prediction equations of the new domestic and global reality may be the Lotka-Volterra predator-prey equations.

D.) The Ayn Rand novel model of life and the economy has valuable insights.

Former Federal Reserve Chairman Alan Greenspan has challenged the academic members of his profession to improve their forecasting by including a priority list of psychological and cultural variables.⁹ Specifically: although Greenspan has mastered the data and ideas in economic forecasting models he also believes that all of us (and the economy) live inside an Ayn Rand novel, a drama in rela-

⁸ Etheredge, *Op. cit.*, p. 25. Drawn from a discussion by Martin Wolf.

⁹ The Map and the Territory (NY: Penguin Press, 2013).

tionship to government and other institutions. The list of variables should recognize basic psychological truths about life, taking responsibility, the work ethic, relations to government (and all authority) and the goal of healthy self-starting, motivated individuals. His views are similar to Governor Romney's psychological diagnosis of 47% of Americans and to the psychological counseling of Reaganomics and Margaret Thatcher, and to the defining economic/psychological truths believed by Paul Ryan, the new Republican Speaker of the House of Representatives. [These views – the “Ayn Rand novel” model – have been acknowledged as a coherent and serious model, held by intellectual leaders of Republicans in Congress, by Paul Krugman (although he thinks that they are dangerous fools).]

It is sometimes alleged that people like Greenspan or Paul Ryan are ideologues who “ignore data.” Although the Krugman’s of the world may eventually prove them wrong, this is partly unfair. Sometimes, their data comes from personal experience and truths that shape their identity. And, while it may have been an historical artifact, econometric modeling evolved from a conventional national accounting system of variables that excluded their ideas from the databases and any Honest Broker estimates from the forecasting models.^{10 11}

¹⁰ Lloyd S. Etheredge, “President Reagan’s Counseling,” Political Psychology (1984), online at www.policyscience.net.

¹¹ Civic optimism also might be possible. Rapid learning about these Republican-model missing variables, with Honest Broker testing, might shift votes, at the margin, to produce creative legislative compromise and improve agreement in Washington. The simple step of including a consumer “mandate” for individual responsibility to buy health insurance – a provision derived from Governor Romney’s compromise health plan in Massachusetts – preserved an essential element of moral and civic health (in the Republican model) and achieved passage of Obamacare.

E.) Breakdowns of Moral Credibility and Trust in Major Institutions

I also derive optimism because there are new theories (that I have suggested) to explain why policies derived from conventional equations (e.g., low interest rates and fiscal stimulus) misdiagnosed the current breakdowns and do not restore confidence reliably. The current crisis was a sudden and frightening breakdown of trustworthiness and moral credibility by major institutions - governments, political systems, and financial institutions. Confidence in the future cannot be restored by traditional remedies alone because these major institutions have not restored confidence in themselves.¹² If true, science-based learning can help to invent better options.

III.) New Rapid Learning Technology

A third perspective also gives optimism about the possibility of a rapid learning system for economics, which might swiftly benefit economic recovery and the future well-being of billions of people.

Specifically: We have new supercomputer-assisted learning technologies that can be applied to Everything Included databases and produce unexpected discoveries quickly. NIH has shown the new rapid learning systems to be stunningly successful and that they can be routinely applied even to 100,000+ variables/case

¹² Lloyd Etheredge, "'Animal Spirits' and Economic Recovery: Reading the Lessons Correctly," online at www.policyscience.net at I. A. See also Robert Shiller: "I suspect that there is a real, if still unsubstantiated, link between widespread anxieties and the strange dynamics of the economic world we live in today" in his "Anxiety and Interest Rates: How Uncertainty is Weighing on Us," The New York Times, February 7, 2015. Online.

and tens of millions of cases: for many centuries cancers were classified by the site of occurrence – now we know, from genetic markers, that there might be ten types of cancer that occur in the breast, each with its own causal pathway and possibility of new, precision treatment. The cost of genetic analysis has dropped more than a million-fold.¹³ Last week, similar initial discoveries of three types of Type II diabetes were announced.¹⁴ And we are just at the beginning of the new rapid learning system.’

The new NIH computer and Big Data strategy also has invented a faster global discovery system. For example, initial discovery thresholds can be set at 0.70 confidence (rather than 0.95) and the results “published” to computer memory for fast further analysis with new samples and without delays for academic publication. Supercomputing analysis for discovery can operate 24x7 at almost the speed of thought, rather than the speed of an NIH or NSF grant process.

The Nobelist Robert Shiller (although without invoking supercomputers, machine-assisted discovery, and Big Data) has recommended this kind of strategy: an inclusive conceptual and data framework that builds economic theory and reliable economic policy on a foundation of how people actually behave. (I am in Shiller’s

¹³ ‘David Reshef et al, “Detecting Novel Associations in Large Sets of Data,” *Science*, 334, (December 16, 2011), pp. 1518-1524; Vogelstein et al., “Cancer Genome Landscapes,” *Science*, 339, (March 29, 2013), pp. 1546-1558.

¹⁴ Francis Collins, “Big Data Study Reveals Possible Subtypes of Type II Diabetes” NIH Director’s blog, posted online November 10, 2015.

camp)¹⁵ . . . There are no guarantees, but the possibility of rapid learning economics is more optimistic than if these technologies did not exist.

Attachments

- Larry Summers, "The Global Economy is in Serious Danger," Washington Post, October 7, 2015.

- Paul Krugman, "Austerity's Grim Legacy," The New York Times, November 6, 2015.

- Lloyd S. Etheredge, "President Reagan's Counseling," Political Psychology, 5:4 (1984), pp. 737-740.

- Francis Collins, "Big Data Study Reveals Possible Subtypes of Type II Diabetes" NIH Director's blog, posted online November 10, 2015.

¹⁵ Etheredge, "A Rapid Learning System . . ." *op. cit.*; NIH's Everything Included /machine-assisted learning strategy also allows an empirical redefining of all variables and classifications.

The global economy is in serious danger

By Lawrence Summers October 7, 2015. The Washington Post.

As the world's financial policymakers convene for their annual meeting Friday in Peru, the dangers facing the global economy are more severe than at any time since the Lehman Brothers bankruptcy in 2008. The problem of secular stagnation — the inability of the industrial world to grow at satisfactory rates even with very loose monetary policies — is growing worse in the wake of problems in most big emerging markets, starting with China.

This raises the specter of a global vicious cycle in which slow growth in industrial countries hurts emerging markets, thereby slowing Western growth further. Industrialized economies that are barely running above stall speed can ill afford a negative global shock.

Policymakers badly underestimate the risks of both a return to recession in the West and of a period where global growth is unacceptably slow, a global growth recession. If a recession were to occur, monetary policymakers would lack the tools to respond. There is essentially no room left for easing in the industrial world. Interest rates are expected to remain very low almost permanently in Japan and Europe and to rise only very slowly in the United States. Today's challenges call for a clear global commitment to the acceleration of growth as the main goal of macroeconomic policy. Action cannot be confined to monetary policy.

There is an old proverb: "You do not want to know the things you can get used to." It is all too applicable to the global economy in recent years. While the talk has been of recovery and putting the economic crisis behind us, gross domestic product

forecasts have been revised sharply downward almost everywhere. Relative to its 2012 forecasts, the International Monetary Fund has reduced its forecasts for U.S. GDP in 2020 by 6 percent, for Europe by 3 percent, for China by 14 percent, for emerging markets by 10 percent and for the world as a whole by 6 percent. These dismal figures assume there will be no recessions in the industrial world and an absence of systemic crises in the developing world. Neither can be taken for granted.

We are in a new macroeconomic epoch where the risk of deflation is higher than that of inflation, and we cannot rely on the self-restoring features of market economies. The effects of hysteresis — where recessions are not just costly but also stunt the growth of future output — appear far stronger than anyone imagined a few years ago. Western bond markets are sending a strong signal that there is too little, rather than too much, outstanding government debt. As always when things go badly, there is a great debate between those who believe in staying the course and those who urge a serious correction. I am convinced of the urgent need for substantial changes in the world's economic strategy.

History tells us that markets are inefficient and often wrong in their judgments about economic fundamentals. It also teaches us that policymakers who ignore adverse market signals because they are inconsistent with their preconceptions risk serious error. This is one of the most important lessons of the onset of the financial crisis in 2008. Had policymakers heeded the pricing signal on the U.S. housing market from mortgage securities, or on the health of the financial system from bank stock prices, they would have reacted far more quickly to the gathering storm. There is also a lesson from Europe. Policymakers who dismissed market signals that Greek debt would not be repaid in full delayed necessary adjustments — at great cost.

Lessons from the bond market

It is instructive to consider what government bond markets in the industrialized world are implying today. These are the most liquid financial markets in the world and reflect the judgments of a large group of highly informed traders. Two conclusions stand out.

First, the risks tilt heavily toward inflation rates below official targets. Nowhere in the industrial world is there an expectation that central banks will hit their 2 percent targets in the foreseeable future. Inflation expectations are highest in the United States — and even here the market expects inflation of barely 1.5 percent for the five-year period starting in 2020. This is despite the fact that the market believes that monetary policy will remain much looser than the Fed expects, as the Fed funds futures market predicts a rate around 1 percent at the end of 2017 compared with the Fed's most recent median forecast of 2.6 percent. If the market believed the Fed on monetary policy, it would expect even less inflation and a real risk of deflation.

Second, the prevailing expectation is of extraordinarily low real interest rates, which is the difference between interest rates and inflation. Real rates have been on a downward trend for nearly a quarter-century, and the average real rate in the industrialized world over the next 10 years is expected to be zero. Even this presumably reflects some probability that it will be artificially increased by nominal rates at a zero bound — the fact that central banks cannot reduce short-term interest rates below zero — and deflation. In the presence of such low real rates, there can be little chance that economies would overheat.

Many will argue that bond yields are artificially depressed by quantitative easing (QE) and so it is wrong to use them to draw inferences about future inflation and real rates. This possibility cannot be ruled out. But it is noteworthy that bond yields are now lower in the United States than their average during the period of quantitative easing and that forecasters have been confidently — but wrongly — expecting them to rise for years.

The strongest explanation for this combination of slow growth, expected low inflation and zero real rates is the secular stagnation hypothesis. It holds that a combination of higher saving propensities, lower investment propensities and increased risk aversion have operated to depress the real interest rates that go with full employment to the point where the zero lower bound on nominal rates is constraining.

There are four contributing factors that lead to much lower normal real rates:

- **First, increases in inequality — the share of income going to capital and corporate retained earnings — raise the propensity to save.**
- **Second, an expectation that growth will slow due to a smaller labor force growth and slower productivity growth reduces investment and boosts the incentives to save.**
- **Third, increased friction in financial intermediation caused by more extensive regulation and increased uncertainty discourages investment.**
- **Fourth, reductions in the price of capital goods and in the quantity of physical capital needed to operate a business — think of Facebook having more than five times the market value of General Motors.**

Emerging markets

Until recently, a major bright spot has been the strength of emerging markets. They have been substantial recipients of capital from developed countries that could not be invested productively at home. The result has been higher interest rates than would otherwise obtain, greater export demand for industrial countries' products and more competitive exchange rates for developed economies. Gross flows of capital from industrial countries to developing countries rose from \$240 billion in 2002 to \$1.1 trillion in 2014. Of particular relevance for the discussion of interest rates is that foreign currency borrowing by the nonfinancial sector of developing countries rose from \$1.7 trillion in 2008 to \$4.3 trillion in 2015.

has now gone into reverse. According to the Institute of International Finance, developing country capital flows fell sharply this year — marking the first such decline in almost 30 years, as the amount of private capital leaving developing countries eclipsed \$1 trillion.

What does this mean for the world's policymakers gathering in Lima? This is no time for complacency. The idea that slow growth is only a temporary consequence of the 2008 financial crisis is absurd. The latest data suggest growth is slowing in the United States, and it is already slow in Europe and Japan. A global economy near stall speed is one where the primary danger is recession. The most successful macroeconomic policy action of the past few years was European Central Bank President Mario Draghi's famous vow that the ECB would do "whatever it takes" to preserve the euro, uttered at a moment when the single currency appeared to be on the brink. By making an unconditional commitment to providing liquidity and supporting growth, Draghi prevented an incipient panic and helped lift European growth rates — albeit not by enough.

Any discussion has to start with China, which poured more concrete between 2010 and 2013 than the United States did in the entire 20th century. A reading of the recent history of investment-driven economies — whether in Japan before the oil shock of the 1970s and 1980s or the Asian Tigers in the late 1990s — tells us that growth does not fall off gently.

China faces many other challenges, ranging from the most rapid population aging in the history of the planet to a slowdown in rural-to-urban migration. It also faces issues of political legitimacy and how to cope with hangovers of unproductive investment. Even taking an optimistic view — where China shifts smoothly to a consumption-led growth model led by services — its production mix will be much lighter. The days when it could sustain global commodity markets are over.

The problems are hardly confined to China. Russia struggles with low oil prices, a breakdown in the rule of law and harsh sanctions. Brazil has been hit by the decline in commodity prices but even more by political dysfunction. India is a rare exception. But from Central Europe to Mexico to Turkey to Southeast Asia, the combination of industrial growth declines and dysfunctional politics is slowing growth, discouraging capital inflows and encouraging capital outflows.

No time for complacency

What is needed now is something equivalent but on a global scale — a signal that the authorities recognize that secular stagnation, and its spread to the world, is the dominant risk we face. After last Friday's dismal U.S. jobs report, the Fed must recognize what should already have been clear: that the risks to the U.S. economy are two-sided. Rates will be increased only if there are clear and direct signs of inflation or of financial euphoria breaking out. The Fed must also state its

readiness to help prevent global financial fragility from leading to a global recession.

The central banks of Europe and Japan need to be clear that their biggest risk is a further slowdown. They must indicate a willingness to be creative in the use of the tools at their disposal. With bond yields well below 1 percent, it is doubtful that traditional quantitative easing will have much stimulative effect. They must be prepared to consider support for assets such as corporate securities that carry risk premiums that can be meaningfully reduced and even to recognize that by absorbing bonds used to finance fiscal expansion they can achieve more.

Long-term low interest rates radically alter how we should think about fiscal policy. Just as homeowners can afford larger mortgages when rates are low, government can also sustain higher deficits. If a debt-to-GDP ratio of 60 percent was appropriate when governments faced real borrowing costs of 5 percent, then a far higher figure is surely appropriate today when real borrowing costs are negative.

The case for more expansionary fiscal policy is especially strong when it is spent on investment or maintenance. Wherever countries print their own currency and interest rates are constrained by the zero bound, there is a compelling case for fiscal expansion until demand accelerates to the point where interest rates can be raised. While the problem before 2008 was too much lending, many more of today's problems have to do with too little lending for productive investment.

Inevitably, there will be discussion of the need for structural reform at the Lima meetings — there always is. But to emphasize this now would be to embrace the macroeconomic status quo. The world's largest markets are telling us with ever-

increasing force that we are in a different world than we have been accustomed to. Traditional approaches of focusing on sound government finance, increased supply potential and avoidance of inflation court disaster. Moreover, the world's principal tool for dealing with contraction — monetary policy — is largely played out and will be less effective if contraction comes. It follows that policies aimed at lifting global demand are imperative.

If I am wrong about expansionary fiscal policy and such measures are pursued, the risks are that inflation will accelerate too rapidly, economies will overheat and too much capital will flow to developing countries. These outcomes seem remote. But if they materialize, standard approaches can be used to combat them.

If I am right and policy proceeds along the current path, the risk is that the global economy will fall into a trap not unlike the one Japan has been in for 25 years, where growth stagnates but little can be done to fix it. It is an irony of today's secular stagnation that what is conventionally regarded as imprudent offers the only prudent way forward.

Austerity's Grim Legacy

NOV. 6, 2015. by Paul Krugman, The New York Times

When economic crisis struck in 2008, policy makers by and large did the right thing. The Federal Reserve and other central banks realized that supporting the financial system took priority over conventional notions of monetary prudence. The Obama administration and its counterparts realized that in a slumping economy budget deficits were helpful, not harmful. And the money-printing and borrowing worked: A repeat of the Great Depression, which seemed all too possible at the time, was avoided.

Then it all went wrong. And the consequences of the wrong turn we took look worse now than the harshest critics of conventional wisdom ever imagined.

For those who don't remember (it's hard to believe how long this has gone on): In 2010, more or less suddenly, the policy elite on both sides of the Atlantic decided to stop worrying about unemployment and start worrying about budget deficits instead.

This shift wasn't driven by evidence or careful analysis. In fact, it was very much at odds with basic economics. Yet ominous talk about the dangers of deficits became something everyone said because everyone else was saying it, and dissenters were no longer considered respectable — which is why I began describing those parroting the orthodoxy of the moment as Very Serious People.

Some of us tried in vain to point out that deficit fetishism was both wrongheaded and destructive, that there was no good evidence that government debt was a problem for major economies, while there was plenty of evidence that cutting spending in a depressed economy would deepen the depression.

And we were vindicated by events. More than four and a half years have passed since Alan Simpson and Erskine Bowles warned of a fiscal crisis within two years; U.S. borrowing costs remain at historic lows. Meanwhile, the austerity policies that were put into place in 2010 and after had exactly the depressing effects textbook economics predicted; the confidence fairy never did put in an appearance.

Yet there's growing evidence that we critics actually underestimated just how destructive the turn to austerity would be. Specifically, it now looks as if austerity policies didn't just impose short-term losses of jobs and output, but they also crippled long-run growth.

The idea that policies that depress the economy in the short run also inflict lasting damage is generally referred to as "hysteresis." It's an idea with an impressive pedigree: The case for hysteresis was made in a well-known 1986 paper by Olivier Blanchard, who later became the chief economist at the International Monetary Fund, and Lawrence Summers, who served as a top official in both the Clinton and the Obama administrations. But I think everyone was hesitant to apply the idea to the Great Recession, for fear of seeming excessively alarmist.

At this point, however, the evidence practically screams hysteresis. Even countries that seem to have largely recovered from the crisis, like the United States, are far poorer than precrisis projections suggested they would be at this point. And a new paper by Mr. Summers and Antonio Fatás, in addition to supporting other economists' conclusion that the crisis seems to have done enormous long-run damage, shows that the downgrading of nations' long-run prospects is strongly correlated with the amount of austerity they imposed.

What this suggests is that the turn to austerity had truly catastrophic effects, going far beyond the jobs and income lost in the first few years. In fact, the long-run damage suggested by the Fatás-Summers estimates is easily big enough to make austerity a self-defeating policy even in purely fiscal terms: Governments that slashed spending in the face of depression hurt their economies, and hence their future tax receipts, so much that even their debt will end up higher than it would have been without the cuts.

And the bitter irony of the story is that this catastrophic policy was undertaken in the name of long-run

responsibility, that those who protested against the wrong turn were dismissed as feckless.

There are a few obvious lessons from this debacle. "All the important people say so" is not, it turns out, a good way to decide on policy; groupthink is no substitute for clear analysis. Also, calling for sacrifice (by other people, of course) doesn't mean you're tough-minded.

But will these lessons sink in? Past economic troubles, like the stagflation of the 1970s, led to widespread reconsideration of economic orthodoxy. But one striking aspect of the past few years has been how few people are willing to admit having been wrong about anything. It seems all too possible that the Very Serious People who cheered on disastrous policies will learn nothing from the experience. And that is, in its own way, as scary as the economic outlook.

The Forum

President Reagan's Counseling

Lloyd S. Etheredge

President Reagan's psychological model of economic behavior is a very different idea of how society operates than the individual rational choice models used by economists. It would be a major contribution to American public policy to develop direct measures of imagination and determine whether people do relate to government, as a higher presence, from within a larger-than-life drama.

KEY WORDS: political economy; mass psychology; leadership; imagination therapy.

For decades, economic policy has been the territory of economists, governed by their idea that we are a nation of rational choices. President Reagan has changed the assumptions. He is using ideas familiar to psychoanalysts and clinical psychologists to diagnose the problems of the American economy and design a course of treatment. He has posed a set of problems which political psychologists can solve with great benefit to the intelligence of national policy.

The president's idea is simple. He says our economy's lack of vitality is produced because government has become a powerful, substantial presence "above" us here in America. Over the past 30 years as, in our national imagination government became "bigger," we grew subjectively smaller to develop a national dependence. There was a "zero-sum" effect on each person's mind: As "it" (government) assumed more responsibility in national life, "we" (the people) took less. The work ethic disintegrated; productivity increases stopped; the economy stalled.

The president's economic policy follows logically. It is intellectually serious and urgent: He must provide national psychotherapy for a depressed, passive nation that expects its therapist to have a prompt and magical solution.

To effect the change he desires, our president-psychiatrist has designed a national psychodrama to inspire us, to create open space, and to reduce our idealized illusions. He is warm and supportive. He is cutting taxes and expenditures to make government above us "smaller." It may not be a cure we like, and there will be painful withdrawal symptoms, but we must again take responsibility for our own lives.

From personal experience, Dr. Reagan knows he is right. The dire predictions of his theory, made 30 years ago, appear correct to him. And in his autobiography, *Where's the Rest of Me?*, he sketches how he, too, was once dependent, in his case on the Hollywood studio system. He was well paid but unhappy, reading scripts written by others, never getting the leading dramatic roles he wanted to play. But then he became more assertive, struck out on his own. Once he became his own man, life started to work for him. He made a successful second marriage. Speaking his own ideas, he was elected Governor of California. Now he has the leading role in the country.

Other aspects of the president's life and experience confirm the same intuitive truth. He enjoys exhilaration, and a sense of freedom, when he rides the open range on horseback, the experience of the open range for free entrepreneurship he has told us we will regain in our national psychology by cutting back that "big government" in the sky. When he escapes to California from Washington and clears brush on his ranch, he feels recharged. He knows we will feel that way too, as the American Congress "stays the course" to effect the psychological transformation he wants.

To be sure, this is a closed system of beliefs. Evidence is always interpreted in the light of what the president calls his "basic principles." If the economic recovery is slow, it only means problems of dependency and addiction to big government are deep in our national psyche. So he is under an even greater obligation to persevere until we regain our independence and self-confidence and restart the economy. He has no choice.

From the president's perspective there is likely a second cause of a slow recovery, a cause psychoanalysts and clinical psychologists often cite: We are resisting. To an unprecedented degree, American news media refuse to discuss a national problem in the language a president uses. He has been stonewalled. *CBS News* has run nightly stories about the sufferings imposed by Reaganomics but has not yet discussed the real national problem, our psychology of dependency. It is as though the Eastern liberal news media are so addicted to the drama of an activist government, so psychologically dependent, so accustomed to demand that the president do something, that they will never admit even the possibility he could be profoundly right.

If Reagan is right, these skeptics slow the cure. The president can cut taxes and expenditures; these are actions in physical reality. But the stakes

are *psychological* reality. For the therapy to work we must agree — that the diagnosis of dependency is right, that big government is receding, that the therapist knows what he is doing.

It is also possible our actor-president is wrong. A powerful bond to government may be true of only 2% of the population: actors, intellectuals, reporters, the people who give money to political causes or end up in Washington. How can we tell?

The president has profoundly challenged the discipline of economics. His idea about how the economy works does not come from the hundreds of complex equations of their mathematical models. The basic problem, in his view, is simple: The economy is deeply *political*; we orient ourselves dependently toward government in a larger-than-life drama.

Lacking objective evidence, we now are adrift and debates about economic policy are decoupled, without intellectual integrity. Administration economists have given no evidence to support the intuitive psychological ideas about the economy the president uses to set policy. They have developed no national indicators for the substantiality of images of a "big" government in the sky, for changes in achievement motivation, for the alleged zero-sum allocations of responsibility.

Now, as we "stay the course," we navigate blind, on faith alone. Congress has applied no rules of evidence. The *Report* of the U.S. government's Council of Economic Advisers is intellectually irrelevant; it would be rejected as a test of the president's theories by any psychology department.

If the president is right, good national psychological indicators will tell us. And, refining our understanding, they might improve the president's policy. John F. Kennedy cut taxes and the economy leaped ahead — but Kennedy also talked about achievement — a New Frontier, a man on the moon by 1970. If psychodrama is needed, perhaps these are the themes to emphasize.

The president is not speaking in metaphors. He believes he is talking about our reality: solid, strong constituents of a national imagination, constituents so powerful in their effects as to destroy the health of a multitrillion-dollar economy and our national spirit. His theories reflect ideas many psychologists have voiced seriously in the past: Psychoanalysts have told us that, via transference, many people relate to government authority, in our "mass psychology," the way as children they regarded their magically powerful parents; David McClelland of Harvard explained the economic rise and fall of civilizations by changes in the imaginations of citizens.

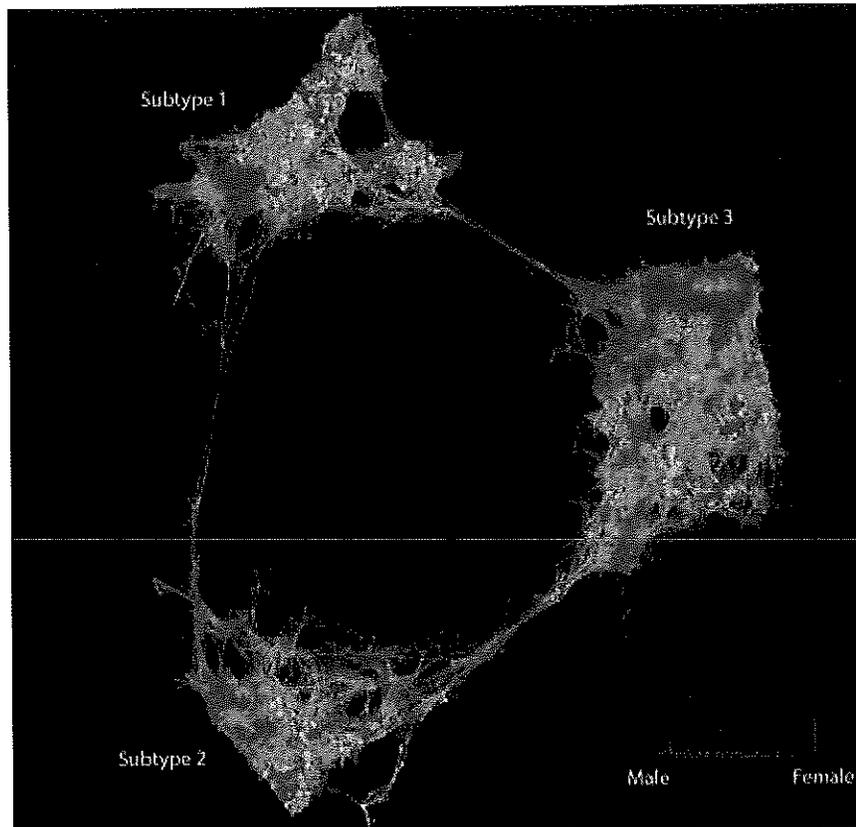
Currently, empirical evidence bearing upon the president's fundamental assumption is indirect and inconsistent. Self-report attitude measures seem to deny his model: Americans say they blame *themselves* for economic hardship. Yet macrolevel studies of election results, and individual-difference measures of self-interested and "socio-tropic" voting, suggest Reagan is cor-

rect and responsibility for management of the economy is assigned to the party in power.

Such measures of attitudes and voting are open to different interpretations as reflecting either rational and secular or psychodramatic processes. Alone, they cannot dispel the fog. The deeper question is the psychological nature of American government, and what is needed is that our public debates begin to be informed by evidence, from appropriate, clinically derived measures, of the location and substantiality of citizens' experience of government and the nature of the emotional bonds to it.

Big Data Study Reveals Possible Subtypes of Type 2 Diabetes

Posted on November 10, 2015 by Dr. Francis Collins



Caption: Computational model showing study participants with type 2 diabetes grouped into three subtypes, based on similarities in data contained in their electronic health records. Such information included age, gender (red/orange/yellow indicates females; blue/green, males), health history, and a range of routine laboratory and medical tests.

Credit: Dudley Lab, Icahn School of Medicine at Mount Sinai, New York

In recent years, there's been a lot of talk about how "Big Data" stands to revolutionize biomedical research. Indeed, we've already gained many new insights into health and disease thanks to the power of new technologies to generate astonishing amounts of molecular data—DNA sequences, epigenetic marks, and metabolic signatures, to name a few. But what's often overlooked is the value of combining all that with a more mundane type of Big Data: the vast trove of clinical information contained in electronic health records (EHRs).

In a recent study in *Science Translational Medicine* [1], NIH-funded researchers demonstrated the tremendous potential of using EHRs, combined with genome-wide analysis, to learn more about a common, chronic disease—type 2 diabetes. Sifting through the EHR and genomic data of more than 11,000 volunteers, the researchers uncovered what appear to be three distinct subtypes of type 2 diabetes. Not only does this work have implications for efforts to reduce this leading cause of death and disability, it provides a sneak peek at the kind of discoveries that will be made possible by the new Precision Medicine Initiative's national research cohort, which will enroll 1 million or more volunteers who agree to share their EHRs and genomic information.

In the latest study, a research team, led by Li Li and Joel Dudley of the Icahn School of Medicine at Mount Sinai, New York, started with EHR data from a racially and socioeconomically diverse cohort of 11,210 hospital outpatients. Of these volunteers, 2,551 had been diagnosed with type 2 diabetes, which is the most common form of diabetes.

Without focusing on any particular disease or condition, the researchers first sought to identify similarities among all participants, based on their lab results, blood pressure readings, height, weight, and other routine clinical information in their EHRs. The approach was similar to building a social network with connections forged, not on friendships, but medical information. When the resulting network was color-coded to reveal participants with type 2 diabetes, an interesting pattern emerged. Instead of being located in one, large clump on this “map,” the points indicating people with type 2 diabetes were actually grouped into several smaller, distinct clusters, suggesting the disease may have subtypes.

To take a closer look, the researchers rebuilt the network to include only participants with type 2 diabetes. They then reanalyzed the EHRs based on 73 clinical characteristics, including gender, glucose levels, and white blood cell counts. That work confirmed that there were three distinct subtypes of type 2 diabetes among study participants.

Type 2 diabetes is associated with potentially serious complications, including nerve damage, vision problems, kidney disease, and an increased risk for cardiovascular disease. The study found differences in the distribution of such complications among the three subtypes of type 2 diabetes. People with subtype 1 were more likely to be diagnosed with microvascular complications, including blindness/vision defects. This group of participants was also the youngest and most likely to be obese. People with subtype 2 showed the greatest risk for tuberculosis and cancer. As for subtype 3, such people were more likely than others to be HIV positive, have high blood pressure, and develop arterial blood clots. Both subtypes 2 and 3 displayed a greater risk for heart disease than subtype 1.

Next, the researchers performed a genomic analysis, identifying hundreds of genetic variants that were enriched non-randomly in each of the three groups. Interestingly, some of the genetic variants linked to each subgroup were associated with genetic pathways that appeared relevant to the distinguishing clinical features of those subgroups.

These findings suggest that some of the clinical differences observed between the different type 2 diabetes subtypes are rooted in lifestyle or environment, and others may be influenced by inherited factors. Still, more research needs to be done to replicate and expand upon these findings. The hope is that by gaining a more nuanced understanding of type 2 diabetes, we may be able to identify more precise ways of helping to detect, manage, and, ultimately, prevent this serious, chronic disease that currently affects about 1 out of every 11 Americans [2].

References:

[1] Identification of type 2 diabetes subgroups through topological analysis of patient similarity. Li L, Cheng WY, Glicksberg BS, Gottesman O, Tamler R, Chen R, Bottinger EP, Dudley JT. *Sci Transl Med.* 2015 Oct 28;7(311):311ra174.

[2] Diabetes Latest Fact Sheet. 2014 June 17. (Centers for Disease Control and Prevention)

February 9, 2016

To: PCAST Members and Interested Colleagues
From: Lloyd Etheredge ¹
Re: **Comment: NSF's (Untrustworthy) Self-Correction Plan**

In 2015 the National Science Foundation published on its Website a scientific self-correction plan to address problems of unreliable research in economics and other social and behavioral sciences. I enclose a copy because the Report illustrates the untrustworthiness of NSF's senior leadership and scientific performance, **even when billions of people must suffer until more reliable economic science is available.** ²

- The evidence ("Trusting the National Science Foundation will not solve this problem") mandates oversight review and swift corrective action, including a briefing to President Obama, at PCAST's level. Also, corrective steps by AAAS, journalists and Editors, and other system-level actors committed to reliable and trustworthy science.

Background

The Report was mandated by growing alarm and pressure about the unreliability of economic science since 2008, by suspicions about published psychological experiments, and by the broader scientific alarms (including NIH) raised by the research of Ioannidis and others. The original mandate was to "assess the scope and magnitude of the problem" of robustness (p. 2) and develop plans to correct these problems by NSF's Social, Behavioral, and Economic Sciences Directorate and others.

However, under the current NSF regime, this analysis was whittled-down and scientific standards were lowered: 1.) There was no professional review of published research; 2.) Notwithstanding earlier design specifications, data about the scope and alarming magnitude of the problems of unreliable macro-economic models – including data about problems known to NSF and uncorrected for many years - were excluded, along with all other data;³ 3.) NSF limited itself to a closed, small, one-day workshop;

¹ Director, Government Learning Project, Policy Sciences Center, Inc., a public foundation. URL: www.policyscience.net; [REDACTED]

² The Report of the Subcommittee on Replicability of Science was prepared under the auspices of the Social, Behavioral and Economics (SBE) Advisory Committee. http://www.nsf.gov/sbe/AC_Materials/SBE_Robust_and_Reliable_Research_Report.pdf which reviewed the Report and authorized its public release.

³ The Report speculates about innocent causes, but NSF has failed to correct known problems of unreliable economic science for several decades, even in the face of brutal confrontations by Committees of Visitors, formal charges to the NSF Inspector General about known missing variables, and professional feedback from government

4.) Economists were excluded from planning and participation in the study and workshop; 5.) The nation's social, behavioral, and economic scientists were not told about the study process. There were no public hearings and their input about the problems, magnitudes, and causes – that might have improved or challenged the Report – were not considered; 6.) There was no public comment period for drafts of national policy recommendations. (These were not made public until the Report was approved and published online.) Essentially, the Advisory Committee decided simply to rewrite a textbook, conceptual, discussion of the many possible sources of unreliable science, suppress known data about the scope and magnitude of the problem (i.e., including the awkward “known to NSF and uncorrected for many years” macro-economic problems)⁴ and recommend a strategy of more studies in every direction.

NSF's methods created a distorted, unreliable analysis and failed to consider rapid and hopeful strategies to achieve robust and trustworthy macro-economic models. **NSF needed to do the competent literature review and evidence-based analysis because it is not difficult to improve the reliability of economic science.** (The paper that I sent to you earlier, “The Optimistic Case for Rapid Learning Economics,” draws from the universe of published literature and lessons that NSF's *seigneurs* decided to omit – e.g., CBO time-series comparisons and lessons of GDP two-year forecasting errors of government and about 50 Blue Chip models since the late 1970s.)⁵ **There is substantial professional agreement about several kinds of missing variables. We have good ideas about where to look for them.** There is a more powerful, informed, useful, competent, reliable, and hopeful Report about scientific reliability and rapid progress that the NSF system did not write.

Earlier, in discussing NSF's performance problems, I suggested to you the advice of the Boston Globe's Editor, portrayed in the movie Spotlight about untrustworthy priests. [i.e., Don't get into cat fights about blame in specific cases: who appointed an SBE scientific self-correction Committee without economists; who decided that national policy recommendations without competent literature reviews, and excluding data about the scope and magnitude of the problem, was an acceptable NSF standard;

users (e.g., CBO). The NSF-SBE Division and Advisory Committee that prepared the Report has conflicts of interest – i.e., a causal role in the uncorrected and growing unreliability of economic science since 2008.

⁴ See also the view of John Ioannidis. In Benedict Carey, “Many Psychology Findings Are Not as Strong as Claimed, Study Says” The New York Times, August 27, 2015: Ioannidis is quoted as saying that the 50% non-confirmation problem reported for 100 psychological experiments “could be even worse in . . . economics.”

⁵ A reference copy of the paper is online at www.policyscience.net.

who “trusted their colleagues” or “trusted their subordinates” too much; who steered the agenda to exonerate the NSF system from a causal analysis of its miserable performance since the late 1970s, etc.] Instead, I think it is time for PCAST to recognize and solve the institutional and system-level problems.⁶

To underscore, again, the urgency: **Billions of people will continue to be injured until the problem of reliable economic science is solved.** The request to the NSF Director and to the National Science Board for a self-correction plan for the Social, Behavioral, and Economic Sciences was a test of their scientific integrity, competence, and professional trustworthiness. They failed. Many accountable (and morally obtuse) people should be replaced, beginning at the top. Then, with other system-level changes, we can have a trustworthy NSF and a more hopeful future.

Attachment

NSF-SBE, Robust and Reliable Research Report (2015).

⁶ System-level solutions include, for example, the Code of Journalistic Ethics for Science that removes duress and creates expectations for a watchdog role in the relationship to NSF.

Social, Behavioral, and Economic Sciences Perspectives on Robust and Reliable Science

*Report of the Subcommittee on Replicability in Science
Advisory Committee to the National Science Foundation Directorate for Social,
Behavioral, and Economic Sciences*

Subcommittee Members:

Kenneth Bollen (University of North Carolina at Chapel Hill,
Cochair)
John T. Cacioppo (University of Chicago, Cochair)
Robert M. Kaplan (Agency for Healthcare Research and Quality)
Jon A. Krosnick (Stanford University)
James L. Olds (George Mason University)¹

Staff Assistance

Heather Dean (National Science Foundation)

Any opinions, findings, conclusions or recommendations presented in this material are only those of the authors; and do not necessarily reflect the views of the National Science Foundation.

May, 2015

¹ James Olds came off the Subcommittee in October, 2014 when he became the Assistant Director for the Directorate for Biological Sciences at NSF.

INTRODUCTION

Scientific knowledge is cumulative. The production of each empirical finding should be viewed more as a promissory note than a final conclusion. If a scientific finding cannot be independently verified, then it cannot be regarded as an empirical fact. And if a literature contains illusory evidence rather than real findings, the efficiency of the scientific process can be compromised.

In recent years, we have seen an accumulation of evidence suggesting that some scientific findings thought to be robust may in fact be illusory (e.g., Ioannidis, 2008). In some instances, initial findings turned out to be intentionally fraudulent, maliciously fabricated rather than being generated through genuine data collection and analysis. Scientists presume that such outright fraud is rare, because instances of it have seldom emerged.

But with the passage of time, an increasing number of studies suggest that conventional scientific practices, including practices routinely taught to students learning to become scientists, may sometimes yield findings that are not reliable because they are the result of well-intentioned data collection, data management, or data analysis procedures that unintentionally lead to conclusions that are not robust.

Although the behaviors that yield illusory findings appear to be occurring across many scientific disciplines, an understanding of these behaviors and the development of measures that can prevent them seem especially well-suited to social, behavioral, and economic scientists. Social and behavioral scientists routinely study the causes of human behaviors and the effectiveness of strategies meant to change behavior. Furthermore, the National Science Foundation (NSF) Directorate for Social, Behavioral and Economic Sciences (SBE) is positioned to establish policies and fund research to mitigate the factors that affect the robustness of scientific research.

In the spring of 2013, the NSF SBE Advisory Committee (AC) established a subcommittee to investigate actions NSF SBE might pursue to promote robust research practices in science. This document constitutes the subcommittee's report.

BACKGROUND

During the summer and fall of 2014, the subcommittee designed a proposal for a workshop on "Robust Research in the Social, Behavioral, and Economic Sciences." This workshop was convened on February 20-21, 2014, at the National Science Foundation, the objectives of which were to: (a) assess the scope and magnitude of the problem, and review and critique the extant recommendations and solutions to promote scientific replicability; (b) foster a reflective and extended dialog among researchers, journal editors, and science administrators about what integrated set of policies and procedures might be acceptable and beneficial to the scientific community; (c) identify a set of recommendations to optimize the incentives for laudatory scientific behavior while minimizing unintended side effects; and (d) position SBE to support research exploring the causes and consequences of scientific behaviors that enhance the likelihood of generating nonreplicable findings and replicable findings, and into research practices to improve the validity of research findings.

A variety of individuals and academic bodies (e.g., funding agencies, scientific associations, journals) have done work on this topic, and this work was considered when constituting the membership of and goals for the workshop. The participants in the workshop were drawn from multiple disciplines and were asked to consider: (i) the scope and magnitude of the problem of nonrobust scientific practices in science, (ii) possible improvements in scientific practice and procedures, (iii) the implications for science education and training, (iv) the implications for editorial policies and procedures, (v) the implications for research university policies and evaluation criteria, and (vi) the implications for federal funding policies and evaluation criteria.

The attendees included experts on each of these issues, but our goal for the workshop was not simply to re-discuss well-known perspectives that had been disseminated during prior conferences or in existing publications. Instead, we asked presenters to: (a) review *briefly* what they saw to be the problems and possible solutions; (b) address the possible costs and unintended side-effects of possible solutions, including the differential costs or impacts on investigators who are engaged in robust scientific practices versus those who may be more susceptible to the situational pressures that impact replicability; and (c) offer recommendations about research that NSF could fund to improve the replicability, validity, generativity, and integration of research across all sciences.

The charge to the subcommittee and the workshop agenda and summary are provided in the Appendices. Our purpose here is to extract some of the key issues that emerged and to outline recommendations for a research agenda that might improve the robustness of research across the sciences. The report is organized as follows. The next section defines key terms. This is followed by several recommendations on reproducibility, replicability, and generalizability. Additional recommendations concern issues of statistical power, confirmation bias, and understanding scientific research as it is practiced. The conclusions follow the recommendations.

DEFINITIONS

We view *robust* scientific findings as ones that are *reproducible*, *replicable*, and *generalizable*. Reproducibility, replication, and generalizability are different though related concepts that are vital to our discussion. In practice, these ideas are sometimes confounded or combined. Because writers do not always use these terms in the same way, we explain our usage. We make no claim to be providing the true meaning of these concepts, but do hope that these definitions clarify our meanings of the terms.

Reproducibility refers to the ability of a researcher to duplicate the results of a prior study using the same materials and procedures as were used by the original investigator. So in an attempt to reproduce a published statistical analysis, a second researcher might use the same raw data to build the same analysis files and implement the same statistical analysis to determine whether they yield the same results. For example, a study might involve OLS regressions conducted using data from the 2014 American National Election Study survey. After publication of the results, another investigator using the same data can attempt to conduct the same analyses. If the same results were obtained, the first set of results would be deemed reproducible. If the same

results were not obtained, the discrepancy could be due to differences in processing of the data, differences in the application of statistical tools, differences in the operations performed by the statistical tools, accidental errors by an investigator, and other factors. Reproducibility is a minimum necessary condition for a finding to be believable and informative.

Replicability refers to the ability of a researcher to duplicate the results of a prior study if the same procedures are followed but new data are collected. That is, a failure to replicate a scientific finding is commonly thought to occur when one study documents relations between two or more variables and a subsequent attempt to implement the same operations fails to yield the same relations with the new data. It also is possible and useful to demonstrate the lack of relations between variables. For instance, an intervention might fail to produce an effect. A second study might investigate the same intervention in a different setting and also find no effect. Thus, null results can also be replicated.

When a single researcher is conducting his or her own study for a second time, it might seem easy to repeat the same data collection and analysis procedures, because the researcher is fully informed about the procedures. But when another researcher in another location did not observe the conduct of the first study and relies on a textual description of its data collection and analysis procedures, critical details may not be fully and effectively understood, so the procedures implemented second may not match the procedures implemented in the initial study. Thus, an apparent failure to replicate a finding may occur because importantly different procedures are used the second time.

More generally, failure to replicate can occur for a number of reasons, including: (1) the first study's methods were flawed, and the variables are not related to one another, (2) the second study's methods were flawed; the variables are truly related to one another, but this was misleadingly not revealed by the second study, (3) the two studies do not disagree with one another, because the association observed in the first study is not statistically significantly different from the association observed in the second study, once we take into account the sampling fluctuations that occur in both studies, or (4) the methods or participants used in the second study are substantively different from those used in the first study, so the second does not match the first in terms of key conditions (e.g., different types of people participated in the first and second studies).

Generalizability refers to whether the results of a study apply in other contexts or populations that differ from the original one. Generalization can be done from one set of human participants in an experiment to other people (e.g., findings generated with college student participants at a large Midwest university might be generalized to the entire U.S. adult population). Generalization can also be done from one persuasive message that was studied in a laboratory experiment to all persuasive messages that could be presented to people in the course of daily life. Generalizability concerns the degree to which found relations apply in different situations. Usually a finding's failure to generalize indicates the operation of limiting conditions, the identification of which advances theory.

RECOMMENDATIONS

With the definitions in hand, we make recommendations to address the robustness of scientific research. The first few recommendations are classified under our concepts of reproducibility, replicability, and generalizability. The others focus on statistical power, confirmation bias, and understanding the scientific research in practice.

Reproducibility

Science should routinely evaluate the reproducibility of findings that enjoy a prominent role in the published literature. To make reproduction possible, efficient, and informative, researchers should sufficiently document the details of the procedures used to collect data, to convert observations into analyzable data, and to analyze data. Therefore, our first recommendation is:

Recommendation 1: Each report of research supported by NSF should be accompanied by detailed documentation on procedures to enable an independent researcher to reproduce the results of the original researcher. A report of what these archives contain and how they are accessible should be required in a project's Final Report and in descriptions of "Prior NSF Funding" in proposals seeking new support.

Ideally, all materials used to collect data, to transform data, and to analyze data would be archived in a public accessible online storage facility. Records of all statistical analysis code and all statistical analysis output should be included in the archive. Any materials collected using paper or other tangible methods should be stored or electronically recorded (e.g., photographs), and any procedures should be videotaped when implemented. These electronic archives should also be made publicly available via the Internet. If materials are purchased, purchase sources and purchase specifications (e.g., for measuring devices) should be recorded in the archive.

If issues of confidentiality preclude sharing all raw data, perhaps summary statistics can be generated (e.g., a matrix of correlations among measured variables) to allow other researchers to reproduce findings using such statistics.

Replicability

If a researcher attempts to replicate a study by using similar procedures to collect new data and similar analytic tools, the similarity of the findings to those of the original study can be compared. Although we have an intuitive sense of what it means for results to replicate, the meaning becomes less clear the more closely we look. One way to judge replication would be that the results are identical across studies. That is, the effect of a manipulation on an outcome variable should be of the same size and significance. Or the correlation between two variables should be of the same size and significance. However, this is quite a strict approach and likely unrealistic.

Another approach would be to calculate a confidence interval around the estimates generated by the two studies and assess whether the confidence intervals overlap. Though this has some

intuitive appeal, there are problems with such an approach (Schenker & Gentleman, 2001). Another possibility is to estimate the same association in the two studies under the constraint that both are equal and to compare the fit of a model that allows each effect to differ in the two different studies. An even more relaxed approach would be to require that an association be of the same sign and statistical significance in the two studies to conclude that replication occurred. Yet another approach would be to focus on effect sizes or other standardized measures of associations between variables and to define replication as obtaining similar effect sizes.

In light of these ambiguities, we offer the following recommendations:

Recommendation 2: NSF should sponsor research that evaluates various approaches to determining whether a finding replicates and to assess which approach(es) under which circumstances are the most helpful for reaching valid conclusions about replicability.

Recommendation 3: To permit assessing replication in various ways, NSF should encourage researchers to report associations between variables using different metrics (e.g., standardized and unstandardized coefficients, effect sizes, odds ratios) and indicating precision of estimates (with standard errors) and to assess the statistical significance of findings using these different methods.

Generalizability

All research occurs in a context that has at least some unique conditions. It could be the population from which the sample is drawn. It could be a particular combination of variables that enhances or depresses effects. In some situations, one variable might substitute for another in bringing about an effect. Alternatively, two or more antecedent conditions might be required to produce an outcome. Thus, the size of an effect can differ across studies when: (a) other (initially unidentified) antecedents vary across these studies, or (b) one or more moderator variables are operating across these studies. Consequently, effect sizes can vary depending on the experimental control over, or contributions of, other influences for the outcome of interest. For instance, a genetic marker may show a strong association to a phenotype when all other factors are held constant, whereas the same genetic marker may show a very weak association to the phenotype in genome-wide association studies when multiple genetic, epigenetic, situational, and gene x environmental interactions influence the phenotype. Inconsistent findings might therefore result from a failure to generalize across the dissimilar conditions in diverse studies rather than a lack of relationships between variables.

Another example comes from research on attitude change (and laboratory research on social behavior more generally). Findings appeared not to replicate, because the same experimental factors (e.g., source credibility) were found to produce different outcomes in different studies. Rather than treat this as a statistical or methodological problem, two distinct mechanisms (routes) were identified through which attitude change could occur, and the theoretical conditions were specified in which a given factor or set of factors would trigger each route. The resulting Elaboration Likelihood Model (Petty & Cacioppo, 1981, 1986) made sense of what had

appeared to be conflicting results and generated predictions of new patterns of data that were subsequently verified. Thus, lack of generalization led to theoretical maturation.

Careful attention to study details (conceptualization, operationalization, experimental control over other potential independent variables, statistical power, execution, analysis, interpretation) increases the likelihood that empirical results constitute robust scientific facts upon which one can build. Minimal robustness suggests that an empirical effect has been established, and failures to replicate the finding using different measures, situations, time points, or populations suggest the operation of potentially important moderator variables (and, thus, generate theoretical questions). Failure to find the same results across these facets of a research design may reflect a failure to generalize and may trigger a search for the operation of a previously unrecognized determinant or moderator variable. Treating such discrepancies as raising theoretical questions rather than simply noting that studies differed in terms of methodology should foster the development of testable hypotheses and, ultimately, more comprehensive theories.

One specific type of difference between studies in the social, behavioral, and economic sciences involves the participants in the research. Some studies are done with college students enrolled in psychology courses at large universities, other studies are done with college students enrolled at small, elite colleges, other studies are done on websites at which people volunteer to participate in research for little or no compensation, and other studies make use of probability samples of precisely specified populations.

Some disciplines have historically treated differences between participant samples as nuisance variables, presumably unrelated to the findings of a study, which are presumed to generalize across all people. Other disciplines have historically placed great value on representative random samples and placed little faith in the generalizability of the findings of studies of haphazard samples of rare subpopulations. Some disciplines have assumed that the findings of laboratory studies are generalizable to real-world, uncontrolled settings outside the lab, whereas other disciplines have believed that insights into real-world thinking and action must be gained by studying cognition and behavior in its natural settings (e.g., studying voting in real national elections instead of in constructed lab settings). Lastly, some disciplines presume that findings transcend time, so results obtained today should be obtained in a replication attempt ten years from now. In contrast, other disciplines place more significance on the impact of temporal context on findings and would treat a replication attempt years after a first study as an attempt to generalize a finding across time. As a result, when inconsistent results are observed across studies, different disciplines reach different conclusions about the likely causes, some calling these instances of lack of replication, while others call them instances of lack of generalizability.

To facilitate gaining insight in the face of such puzzles, we recommend:

Recommendation 4: NSF should sponsor research that identifies optimal procedures for practically assessing all types of generalizability of findings (e.g., from a set of study participants to a population, from one set of measures to other measures, from one set of circumstances to other circumstances) and differentiating lack of generalizability from failure to replicate.

Statistical Power

Consider again the case in which a study is conducted twice, the results appear to be different (e.g., one study yields a statistically significant treatment effect and the other does not), but a test of the two effects suggests that there is no statistically significant difference. One might conclude that the results replicate. However, in truth, this pattern of data may be illusory, the result of insufficient statistical power. The smaller is the number of observations analyzed, the larger is the standard error of the estimated effect. So the uncertainty resulting from small samples might reduce the statistical power to detect differences in effects even when they are present.

Small samples can also cause problems in another way. An experiment can be run with a small sample relatively quickly and easily. So if the results of a small sample run of an experiment are not what an experimenter expects to see, it is minimally costly to discard the data on the grounds that “something must have gone wrong in the implementation” and conduct the experiment again. Multiple runs of an experiment increase the chance that an apparently statistically significant finding will appear which is in fact an illusory result of chance-alone variation in results across experiments.

Stated more generally, studies with small samples and minimal statistical power are likely to yield inaccurate pictures of reality when combined with only a subset of these findings being reported (e.g., Button et al., 2013). Studies with small samples reduce the probability of detecting a true effect (due to low statistical power), increase the probability that the effect size of a true effect is overestimated (due to the use of $p < .05$ to identify when an effect has been “detected” and the larger sampling error associated with smaller sample sizes), and increase the probability that an apparently statistically significant effect is not truly different from zero (due to differences in the base rates for tests of true and untrue effects). Because initial effect size influences calculations of the needed statistical power for replications, replication attempts with ample statistical power to detect a *reported* (i.e., over-estimated) effect may be underpowered to detect the *true* effect.

One means of increasing statistical power is to increase sample size. Increasing sample size while holding all other variables constant increases the precision of an effect size estimate (i.e., statistical power) by decreasing standard errors. For many researchers, however, increasing sample size may be very difficult and costly, as when studying rare subpopulations. And generally stated, collecting larger samples of data requires larger research budgets.

One illustration of this problem is in the arena of studies using functional magnetic resonance imaging (fMRI). These studies tend to involve very few participants, due to the high cost of collecting data from each participant. Therefore, these studies are routinely underpowered. In order for fMRI studies to be well powered, the total budget supporting such work would need to be substantially increased, or the number of such studies would need to be decreased.

One might imagine that quantitative meta-analyses of such studies can yield enhanced statistical power by combining data from large numbers of participants. However, authors’ reporting habits inhibit the effectiveness of such meta-analyses. In order to be included in a meta-analysis,

a study's report must provide exact estimates of effect sizes and p-values or other such statistics. Unfortunately, however, use of the arbitrary cut-off of $p < .05$ has often led researchers to report simply whether a p-value is above or below that threshold and not to report sizes of effects that are not statistically significant. Consequently, meta-analyses of fMRI studies can aggregate only the effect sizes for studies in which the test of an effect reached statistical significance. Given the small sample size in most neuroimaging research, small but theoretically important effects are therefore likely to go undetected (due to low statistical power), thereby providing at best an incomplete and at worst a misleading depiction of underlying neural mechanisms. A solution to this problem may be relatively simple: creating and enforcing standards for full reporting of the results of statistical analyses to allow comprehensive and precise meta-analyses.

Recommendation 5: NSF should fund research exploring the optimal and minimum standards for reporting statistical results so as to permit useful meta-analyses.

Confirmation Bias

Confirmation bias refers to a tendency to search for or interpret information in a way that confirms one's preconceptions or hypotheses, to avoid exposure to challenging information, and to discredit the challenging information one does encounter. Much research has documented confirmation bias in people's acquisition and processing of information.

In that light, it should come as no surprise that scientists may also manifest confirmation bias. Scientists may actively seek out and assign more weight to evidence that confirms their hypotheses and ignore or underweight evidence that could disconfirm their hypotheses. When the results of a study are not as expected, an investigator may be highly motivated to check over the data processing in search of accidental errors that can be corrected, whereas when expected results are obtained, such thorough scrutiny may be less likely, and errors may go undetected.

The computation of statistics when analyzing empirical data is not always governed by rules that clearly and specifically prescribe just one way to analyze a set of data. Most often, multiple different analytic approaches could be considered legitimate for a single application. For example, data might be legitimately analyzed using ordinary least squares regression or logistic regression. A continuous variable might be entered in its original metric in a regression, or it could be subjected to a log or square root transformation. These and other choices of researchers can produce sets of results that differ importantly in their implications.

Checking robustness of findings to seemingly arbitrary analytic approach differences is a recommended component of any investigation. But generating many different sets of results and selecting one to report simply because it confirms a researcher's expectations is a behavior referred to as "p-hacking": a disingenuous attempt to generate a publishable result when the full array of available evidence raises questions about its replicability.

A variety of other "questionable research practices" have been identified, including:

- (a) failing to report analyses of all of the measures collected in a study and describing

only those that yield desired findings;

(b) deciding whether to collect more data after determining whether obtained results with a smaller sample document desired results;

(c) failing to report analyses of data from all relevant experimental conditions that were executed in the course of data collection, because data from those conditions did not yield desired results;

(d) stopping collecting data earlier than initially planned because desired results have already been obtained;

(e) “rounding off” a p value in a way inconsistent with conventional practice (e.g., reporting that a p value of .054 is less than .05) in order to enhance the apparent robustness of a desired finding;

(f) reporting only studies that produced desired findings and discarding studies that did not produce desired findings;

(g) deciding to exclude data points only after determining that doing so will enhance the degree to which a study seems to produce desired findings;

(h) keeping in data points because without them the desired findings will no longer be found;

(i) reporting an unexpected finding as if it had been predicted *a priori* and thereby increasing its apparent plausibility;

(j) claiming that analytic results are unaltered by controlling for other variables when this has not been fully checked empirically.

The desire to produce findings in line with one’s prior publications and to avoid discrediting one’s own prior work, to earn tenure and promotion in academic settings, to be awarded grant funds, to gain visibility in scientific circles and beyond, and other forces may encourage researchers to engage in p-hacking, thus filling the literature with false findings. In general terms, undesirable researcher behaviors have been referred to as “questionable research practices”: practices that can yield illusory findings though that can also be used to assure that findings are robust.

In light of the inefficiencies and inaccuracies that result from p-hacking and other forms of confirmation bias, we recommend:

Recommendation 6: NSF should support research into the use of questionable research practices, the causes that encourage such behavior, and the effectiveness of proposed interventions intended to discourage such behavior and should support the identification

of empirically-validated optimal research practices to avoid the production of illusory findings.

Recommendation 7: In NSF grant proposals, investigators should be required to describe plans for implementing and fully reporting tests of the robustness of findings using alternate analytical methods (when appropriate). In addition, researchers should be encouraged to design studies whose outcomes would be theoretically interesting regardless of the outcome, or of seriously considering more than one hypothesis. In grant progress reports and final reports, investigators should be required to describe whether more than one hypothesis was considered, the robustness checks conducted and results obtained.

Understanding Scientific Practice

In some fields, conventional practices have been widely adopted by investigators and have unintentionally caused findings to be illusory (e.g., Vul et al., 2009) or incorrectly interpreted (e.g., Jussim, 2012). Therefore, in addition to studying individual findings and their robustness, there is value in studying the research practices of various scientific disciplines, to explore whether any traditional practices might undermine the efficiency of theory development.

Consider, for example, an experiment to be conducted with members of a specific population. Participants might be randomly sampled from the population, they might be randomly assigned to either a treatment or control condition, the number of participants might be sufficient to yield the needed statistical power to detect an effect of the treatment, and optimal measures of outcome variables might be administered. But in practice, participants might not comply with the treatment regimen (e.g., taking an aspirin every single day), data may not be collected from all participants because some drop out of the study entirely or fail to provide needed assessments, distributions of data may violate the assumptions underlying the statistics computed, and tests of statistical significance may not properly take into account all sources of non-independence and uncertainty in observed patterns. In some fields such departures from the ideal are recognized and addressed directly by investigators, while in other fields such departures are largely overlooked.

SBE scientists are especially well equipped to understand the development and maintenance of field-wide norms of conduct that undermine research robustness. In-depth interviews, participant observation, and other qualitative methods hold promise in deepening our understanding of scientific research in practice. Survey methods, administrative data, meta-analysis, and other quantitative research approaches permit us to tackle this issue from other angles. Working together, SBE scientists can document departures from the ideals of scientific investigation in practice that are widespread within fields. This in turn can provide insight into the major sources of non-robust research findings.

Recommendation 8: NSF should sponsor research seeking to document suboptimal practices that are widespread in particular fields, with an eye towards identifying those

areas that most depart from the scientific ideals and contribute to nonrobust research findings.

CONCLUSION

Science is a cumulative process that hinges on the repeated investigation of the same questions from many angles. Because each study builds on the insights produced by prior studies, efficiency of the scientific process can be substantially compromised if a literature includes studies that report illusory results, produced either intentionally or unintentionally. Similarly, scientific efficiency will be compromised if failures to produce expected findings are misdiagnosed as failures to reproduce earlier results or failures to replicate earlier studies when in fact they are failures of earlier findings to generalize.

It is therefore in the interest of all sciences to:

- 1) Identify questionable research practices that cause illusory findings to make their way into the published literature.
- 2) Encourage attempts to reproduce, replicate, and generalize scientific findings.
- 3) Conduct careful investigations when attempts to reproduce, replicate, and generalize scientific findings fail, in order to correctly diagnose the causes.
- 4) Identify forces that encourage scientists to implement questionable research practices.
- 5) Propose and test interventions that are meant to reduce the frequency with which questionable research practices are implemented.

Much can be done by NSF SBE to promote all of the above, and we look forward to it doing so. In light of upcoming work we hope will be conducted, we recommend:

Recommendation 9: NSF should create a Foundation-wide committee of experts to monitor issues of reproducibility, replicability, and generalizability of findings, to support investigations of these issues and disseminate insights gained both within the Foundation and outside the Foundation, to propose ways to change the NSF granting process to enhance scientific quality and efficiency, and to provide leadership on these issues in the coming decades.

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Appendices

- A. Subcommittee on Replicability in Science, Advisory Committee to the National Science Foundation Directorate for Social, Behavioral, and Economic Sciences: Charge and Members
- B. *Robust Research in the Social, Behavioral, and Economic Sciences*: Workshop agenda
- C. *Robust Research in the Social, Behavioral, and Economic Sciences*: Workshop summary

Appendix A

National Science Foundation (NSF)
Directorate for the Social, Behavioral, and Economic Sciences (SBE)
Replicability in Science
A Subcommittee of the Advisory Committee (AC) for the Social, Behavioral and Economic
Sciences

Charge

The Subcommittee on Replicability in Science will work with NSF Staff and various communities to deliver recommendations to the SBE AC in Fall, 2013.

The scope of the subcommittee will include the following:

- Examination of the current state of knowledge regarding issues of replicability in the SBE sciences such as:
 - Institutional norms, including publication bias
 - Generalizability versus replicability
 - Research on robust research practices
- Identifying partners
- Consideration of the resources, both human and financial, needed to encourage robust research practices and replication of scientific findings
- Consideration of the relationship between the challenge of replicability and the potential offered by the recent Office of Science Technology Policy memo on enhanced access to data and publications
- Recommendations for future actions

Input to be used by the Subcommittee will include, but not be limited to:

- Data available from NSF and other sources;
- Input from individual members of the community, either obtained individually or through workshops and other forums;
- Discussions with program officers, other NSF staff, and NSF leadership across the Foundation.

Recommendations in the report should include, but not be limited to:

- Areas of science where future investment in replicability are likely to produce significant transformative increases in the likelihood that published data are replicable and trustworthy;
- Appropriate mechanisms for supporting replicability in the future. Examples would include individual research grants or funds for graduate training in statistics;
- Opportunities for collaboration across and beyond NSF to ensure increased likelihood of replicability in SBE sciences;
- Other comments the subcommittee deems relevant to the charge.

While the subcommittee is not required to announce its meetings and hold them open to the public because it will be reporting directly to the SBE AC, any documents received by or created by the subcommittee may be subject to access by the public. The subcommittee should deliver its final report and present a summary of this report for consideration of acceptance by the SBE AC at its meeting in November, 2013.

April 1, 2013

Subcommittee on Replicability in Science:

Kenneth A. Bollen, University of North Carolina, Chapel Hill (CoChair)

John T. Cacioppo, University of Chicago (CoChair)

Jon A. Krosnick, Stanford University

Robert M. Kaplan, Agency for Healthcare Research and Quality

James L. Olds, George Mason University

NSF SBE Liaison: Heather Dean

Appendix B

Robust Research in the Social, Behavioral, and Economic Sciences
Directorate for Social, Behavioral, and Economic Sciences (SBE)
Advisory Committee (AC) Subcommittee on Replicability in Science
National Science Foundation (NSF)

A Two-Day Workshop at NSF
February 20-21, 2014
Agenda

Day 1

- 8:15 am - 8:30 am: Welcome and Opening Remarks
Joanne Tornow, Acting Assistant Director, SBE
John Cacioppo, University of Chicago, SBE AC Subcommittee CoChair
- 8:30 am - 10:30 am: Panel I – Scope and Magnitude of the Problem and Recommendations for Scientific Practice: I
Moderator: Kenneth Bollen, University of North Carolina, Chapel Hill
Participants:
1. Brian Nosek, University of Virginia
2. Hal Pashler, University of California, San Diego
3. Patricia Devine, University of Wisconsin
4. Leslie K. John, Harvard University Business School
- 10:30 am - 12:30 pm: Panel II – Scope and Magnitude of the Problem and Recommendations for Scientific Practice: II
Moderator: James Olds, George Mason University
Participants:
1. Gregory Francis, Purdue University
2. David Funder, University of California, Riverside
3. Ron Thisted, University of Chicago
4. Katherine Button, University of Bristol
- 12:30 pm - 1:30 pm: Lunch Break
- 1:30 pm - 3:30 pm: Panel III – Education & Training
Moderator: Robert Kaplan, Office of Behavioral and Social Sciences Research, National Institutes of Health (OBSSR, NIH)
Participants:
1. Jo Handelsman, Yale University
2. Simine Vazire, Washington University in St. Louis
3. Richard Ball, Haverford College
4. Larry Hedges, Northwestern University

- 3:30 pm - 3:45 pm: Break
- 3:45 pm - 5:45 pm: Panel IV – Editorial/Journal Policies and Procedures
Moderator: Jon Krosnick, Stanford University
Participants:
1. Marcia McNutt, American Association for the Advancement of Science, *Science*
2. Bobbie Spellman, University of Virginia, *Perspectives on Psychological Science*
3. Eric Eich, University of British Columbia, *Psychological Science*
4. Giorgio Ascoli, George Mason University, *Neuroinformatics*
- 5:45 pm - 6:00 pm: Day 1 Wrap-up
John Cacioppo, University of Chicago
- Day 2
- 8:30 am - 9:00 am: Review of Proposals with Pros & Cons
Moderator: Robert Kaplan, OBSSR, NIH
- 9:00 am - 11:00 am: Panel V – Institutional Policies and Procedures
Moderator: Kenneth Bollen, University of North Carolina, Chapel Hill
Participants:
1. Alan Kraut, Association for Psychological Science
2. Richard Saller, Stanford University
3. Gary VandenBos, American Psychological Association (APA)
4. Barbara Entwisle, University of North Carolina, Chapel Hill
5. Brad Hesse, National Cancer Institute, NIH; Chair, APA Publications Board
- 11:00 am - 1:00 pm: Lunch break
- 1:00 pm - 3:00 pm: Panel VI – Funding Agency Opportunities and Policies
Moderator: Jon Krosnick, Stanford University
Participants:
1. Elena Koustova, National Institute on Drug Abuse, NIH
2. Robert Kaplan, OBSSR, NIH
3. Richard Nakamura, Center for Scientific Review, NIH
4. Philip Rubin, Office of Science and Technology Policy
- 3:00 pm - 3:30 pm: Break
- 3:30 pm - 4:30 pm: Reflection and Group Discussion
Conclusions and Next Steps
Participant: Anthony Greenwald, University of Washington

Appendix C

Robust Research in the Social, Behavioral and Economic Sciences
Directorate for Social, Behavioral, and Economic Sciences (SBE)
Advisory Committee (AC) Subcommittee on Replicability in Science
National Science Foundation (NSF)

A Two-Day Workshop at NSF
February 20-21, 2014
Workshop Summary

Welcome and Opening Remarks

Joanne Tornow, Acting Assistant Director, SBE, and John Cacioppo, CoChair of the SBE Advisory Committee Subcommittee on Replicability in Science, welcomed the participants, thanked the workshop organizers and described the goals of the workshop. They also articulated the importance of scientific replicability, not just to the SBE sciences, but to the entire scientific and engineering enterprise.

Panels I and II. Scope and Magnitude of the Problem and Recommendations for Scientific Practice

Panel I participants:

Brian Nosek, University of Virginia
Hal Pashler, University of California, San Diego
Patricia Devine, University of Wisconsin
Leslie K. John, Harvard University Business School
Kenneth Bollen, University of North Carolina, Chapel Hill (moderator)

Panel II participants:

Gregory Francis, Purdue University
David Funder, University of California, Riverside
Ron Thisted, University of Chicago
Katherine Button, University of Bristol
James Olds, George Mason University (moderator)

The first two panels of the workshop were devoted to identifying contributors to irreproducibility, the scope and magnitude of the problem, and possible solutions. The speakers reinforced the importance of replicability to the progress of science and to its credibility, not only for scientists, but for the taxpaying public and policy-makers as well. It was also noted that while scientific fraud receives a great deal of media attention, it is in fact extremely rare, and not the focus of the workshop's discussions.

With that as context, the panel presentations and discussions surfaced a range of other factors and scientific practices that contribute to irreproducibility:

- A scientific culture that incentivizes the publication of novel, positive results, relegating negative results and replication studies to the “file drawer”;
- Questionable research practices such as
 - terminating studies as soon as the desired results are attained;
 - dropping observations, measures, items or conditions after looking at outcomes of interest;
 - running multiple experiments with similar procedures and reporting only those yielding significant results;
- Inadequate statistical power and sample sizes;
- Researcher bias;
- Subtle changes in methodology and execution when investigators attempt to repeat previously published studies; and
- Differences in study subject selection or setting when studies are repeated.

There was also considerable discussion of the terms, *replicability* and *reproducibility*. There is no consensus on their definitions and they are often used interchangeably to depict a variety of outcomes. These include duplicating a result when re-analyzing the original data from a study or when repeating an entire experiment with as much fidelity to the original as possible. In contrast, failure to obtain the same result when an experiment is repeated in a different setting or with different subjects may be an issue of *generalizability*, revealing important information about the phenomenon under investigation and prompting additional scientific exploration.

Another overarching consideration was how we conceptualize replication. Exact replication should not be expected. Similar experiments might be considered point estimates in distributions of results of repeated executions of the same experiment. It was also suggested that we move away from our “pass-fail” model of individual scientific studies and instead, consider studies in the context of a whole program of research. Statistical tools to estimate the probability that a study has produced a reliable result in the context of other studies on the same topic can facilitate this approach.

The speakers recommended numerous solutions to improve scientific replicability, several of which centered on increasing the transparency of the scientific process. This more open science would encompass:

- Sharing data, analysis code, and study materials;
- Providing methodological details of research;
- Disclosing all data exclusions, manipulations, and measures in studies; and
- Registering studies, requiring pre-specification of primary and secondary outcomes, study design, expected sample size, and data analysis plan.

A second set of solutions focused on data analysis and reporting in grant proposals and publications. Specific suggestions included the following:

- De-emphasizing statistical significance as an outcome or an objective /criterion for publication;
- Using Bayesian methods to account for multiple sources of variation;
- Requiring federal funding applicants to describe their inference populations, sampling methods, and methods to assess the match between sample and population;
- Contracting out statistical analysis of datasets to avoid conflicts of interest;
- Requiring manuscript authors to discuss sample sizes and statistical power, and report effect sizes and 95% confidence intervals for their studies; and
- Encouraging more meta-analysis as a formal process to quantify accumulating knowledge, and making studies “meta-analyzable” through use of standardized protocols, instruments and measures.

A third set of solutions targeted incentives and opportunities for replication and open science, such as:

- Providing funding for replication studies;
- Providing publication outlets for replication studies;
- Creating replication consortia;
- Incentivizing open science through the use of "badges" by journals to signal to readers that the study was registered, and that the authors had signed statements certifying the legitimacy of their execution and analysis of study procedures;
- Striking a balance between federal funding of groundbreaking work and definitive research, as the latter would more likely include replication; and
- Encouraging collaboration among investigators to increase statistical power and replicate findings.

Some of the recommended solutions are already being implemented. The Center for Open Science in Charlottesville, VA was founded in 2013. It builds and distributes tools and provides products and services to improve the openness, integrity, and reproducibility of scientific research. The Center’s primary infrastructure is the Open Science Framework, which provides project management support to research teams through the entire research lifecycle: planning, execution, reporting, archiving and discovery. Another resource is Psych FileDrawer, a web archive of replication attempts in experimental psychology. The website is designed to make it quick and convenient to upload reports but also to require enough detail to make the report credible and responsible. The site also provides a discussion forum for each posting, allowing users to discuss the report (potentially allowing collective brainstorming about possible moderator variables, defects in the original study or in the non-replication attempt, etc.).

Scientific societies are also addressing irreproducibility. The Society for Personality and Social Psychology (SPSP) Task Force has recommended a number of changes in SPSP journal policies: having authors discuss sample size and statistical power; report effect sizes and 95% confidence intervals of findings; and include in an appendix the verbatim wording of instructions, manipulations and measures, in all manuscripts submitted for publication. In addition, the Task Force recommended development of a data sharing policy, explicit mention of replications as among the types of articles that journals will consider, and the creation of additional outlets for publication of replication studies.

Panel III: Education & Training

Panel participants:

Jo Handelsman, Yale University

Simine Vazire, Washington University in St. Louis

Richard Ball, Haverford College

Larry Hedges, Northwestern University

Robert Kaplan, Office of Behavioral and Social Sciences Research, National Institutes of Health (NIH; moderator)

Following the identification of the scope of the problem and potential solutions, the discussion turned to the need for better education and training to improve scientific replicability. The speakers in the third panel of the workshop offered numerous suggestions to do so:

- Improved training in ethics (with periodic refresher courses);
- Earlier, stronger and more consistent training across the SBE sciences in statistics, including instruction in effect sizes and confidence intervals, statistical power, and meta-analysis/meta-analytic thinking;
- Encouraging a culture of “getting it right” rather than “finding significant results” during training;
- Teaching transparency in data reporting, including the reporting of “imperfect” results, and telling the “whole story”, rather than a “good story”;
- Improving methodological education by teaching students to avoid QRPs;
- Educating students in replication and data-sharing and supporting the development of educational materials to do so;
- Cross-training in different fields to improve scientists’ abilities to identify uncontrolled variables; and
- Using published data to teach students the scientific method, methodological transparency, and the importance of replication.

It was acknowledged that the gate-keepers of science (e.g., journal editors, university administrators, hiring and promotion committees, and funding agencies) would need to model, endorse and reward good scientific practices. There was also additional discussion of the magnitude of change needed to produce the desired result of more robust science: a wholesale restructuring of training in the SBE sciences vs. more modest changes in the curriculum.

Panel IV. Editorial/Journal Policies and Procedures

Panel participants:

Marcia McNutt, American Association for the Advancement of Science, *Science*

Bobbie Spellman, University of Virginia, *Perspectives on Psychological Science*

Eric Eich, University of British Columbia, *Psychological Science*

Giorgio Ascoli, George Mason University, *Neuroinformatics*

Jon Krosnick, Stanford University (moderator)

The fourth panel of the workshop presented the perspective of scientific journal editors. They confirmed that numerous scientific disciplines are grappling with the challenge of ensuring scientific replicability and described a variety of steps they are taking to address the challenge. These efforts take different forms:

- *Neuroinformatics* publishes original articles and reviews with an emphasis on data structure and software tools related to analysis, modeling, integration, and sharing in all areas of neuroscience research. In addition to the traditional original scientific articles, *Neuroinformatics* publishes “data original” articles. These are full length manuscripts reflecting an original, significant data contribution to the neuroscience field, that are fully referenced and abstracted, and peer reviewed.
- *Science* has adopted recommendations from the National Institute of Neurological Disorders and Stroke (National Institutes of Health) for the reporting of preclinical studies (Landis et al., 2012). At a minimum studies should report on sample-size estimation, whether and how animals were randomized, whether investigators were blind to the treatment, and the handling of data. In addition, the journal has added additional members to its Board of Reviewing Editors from the statistics community, and is hosting a series of workshops on replicability in different scientific disciplines.
- *Perspectives on Psychological Science* is starting to publish new types of articles: “Ideas to Watch”, short papers describing ideas that are good and suggestive though not yet complete, and “Say it Ain’t So”, a series that will correct long-standing literature after it has moved forward. It has also initiated a Registered Replication Report article type that is a collection of independently conducted, direct replications of an original study, all of which follow a shared, predetermined protocol.
- *Psychological Science* has introduced five new initiatives aimed at raising the bar on publication standards and practices: removal of word limits on Methods and Results sections; clarification of criteria for manuscript evaluation; a badge system to promote open scientific practices (e.g., open data, open materials, or pre-registered studies); placing less emphasis on null hypothesis significance testing and more on effect sizes, confidence intervals, and meta-analysis; and enhancing the reporting of research methods. *Psychological Science* also conducted a disclosure statement pilot experiment, the aims of which were to assess authors’ willingness to disclose methodological information that is not normally reported under current publication guidelines, and to develop a clear picture of what disclosure statements would look like, should the journal decide to require them in the future. The project’s results suggested that disclosure statements could deliver important information about research methodology (e.g., data exclusions, dropped manipulations, or dropped measures, and how sample size was determined) and can be completed quickly, without significantly impacting manuscript submission rates.

Panel V. Institutional Policies and Procedures

Panel participants:

Alan Kraut, Association for Psychological Science
Richard Saller, Stanford University
Gary VandenBos, American Psychological Association (APA)
Barbara Entwisle, University of North Carolina, Chapel Hill
Brad Hesse, National Cancer Institute, NIH; Chair, APA Publications Board
Kenneth Bollen, University of North Carolina, Chapel Hill (moderator)

The workshop's fifth panel presented the perspectives of university administrators and professional scientific societies. The university representatives reinforced observations made earlier in the workshop, i.e., that research misconduct (fraud) is extremely rare, and that irreproducibility is not unique to the SBE sciences. Participants also noted that the incentive structures of universities may be contributing to scientific irreproducibility, including the perceptions of junior researchers about what is valued by their institutions, and expectations for tenure. Their recommendations for universities' roles in ensuring robust science include the following:

- Reinforcing the value of research integrity in their faculty appointment and promotion processes;
- Encouraging best practices through mentoring younger faculty, postdocs, and graduate students; and
- Developing models for data storage, sharing and archiving.

The representatives from the Association for Psychological Science (APS) and American Psychological Association (APA) provided additional examples of activities that demonstrated that the SBE sciences are at the forefront of discussions about scientific replicability:

- The APS special issue on replicability and good research practices has been downloaded 500,000 times, and by researchers well beyond psychological science;
- The APA Task Force on Replication in the Psychological Literature is developing guidelines to specify criteria for a "good" replication study;
- APA has authorized its journals to have independent, online-only, peer-reviewed "replication sections", and established the *Archives of Scientific Psychology* as an open methods, collaborative, data-sharing, open access journal.

Speakers in this panel articulated additional benefits of data sharing. In addition to enabling replications, data sharing promotes aggregation for knowledge synthesis, hypothesis generation, programmatic decisions, and generalizability testing. It provides opportunities for data analysis with more powerful analytic techniques than were available when the data were originally collected. They also identified a number of additional issues to explore in discussions of scientific robustness:

- Ensuring the protection of human subjects in the context of data sharing and data repositories;
- Supporting the evolution of the scientific publishing enterprise through development and deployment of infrastructure, including the development of easy-to-use tools for researchers, and services designed to improve replication and data sharing; and

- Re-examining an incentive structure that encourages investigators to create new and innovative instruments that results in the collection of data that are difficult to harmonize.

Panel VI. Funding Agency Opportunities and Policies

Panel participants:

Elena Koustova, National Institute on Drug Abuse, NIH

Robert Kaplan, Office of Behavioral and Social Sciences Research, NIH

Richard Nakamura, Center for Scientific Review, NIH

Philip Rubin, Office of Science and Technology Policy

Jon Krosnick, Stanford University (moderator)

The sixth panel in the workshop was devoted to federal agencies' roles in enhancing scientific reproducibility. The NIH Office of Behavioral and Social Sciences Research (OBSSR) is responsible for promoting and coordinating behavioral and social sciences research across the agency and has been working on the problem of replication since 2011. In early 2012, OBSSR, in collaboration with the National Institute on Aging, National Institute of Mental Health, National Library of Medicine and APS held a meeting of thought leaders to discuss the topic. This effort spawned the Registered Replication Report initiative in *Perspectives on Psychological Science* that was described earlier in the workshop. OBSSR is also working with an international group to develop CONSORT-SPI, an extension of the CONSORT Guidelines for social and psychological interventions. CONSORT (Consolidated Standards of Reporting Trials) encompasses various initiatives to alleviate the problems arising from inadequate reporting of randomized, controlled, clinical trials.

In addition, the NIH leadership published a paper in *Nature*, outlining its initiatives to enhance reproducibility of pre-clinical research (Collins and Tabak, 2014). These efforts are focused on raising community awareness; enhancing formal training; improving the evaluation of grant applications; protecting the integrity of science by adoption of more systematic review processes; and increasing stability for investigators. Specific NIH activities to address these needs include the following:

- Experimenting with checklists to ensure more systematic evaluation of experimental design and analysis in grant applications;
- Piloting assignment of specific reviewers to evaluate the scientific premises on which grant applications are based;
- Developing a new training module on enhancing reproducibility and transparency for intramural postdoctoral fellows and for broader dissemination;
- Launching PubMed Commons, a pilot program testing options for scientists to post online comments on original research articles; and
- Considering grant mechanisms that allow more flexibility and a longer period of support than currently available, to provide greater stability for investigators at certain career stages.

The discussions during this panel also revealed concerns about some of the recommended solutions to improve replicability. The use of simple checklists for peer review of research grant

applications' methodologies, for example, might have the unintended consequence of stifling scientific creativity. An overzealous shift toward replications studies could slow the progress of science. Participants also reiterated the importance of engaging the scientific community in any development of solutions to improve replicability.

Conclusions and Next Steps

Participant: Anthony Greenwald, University of Washington
John Cacioppo, University of Chicago, and James Olds, George Mason University (moderators)

The final session of the workshop was a lively discussion of many of the earlier ideas for making research more robust and replicable. It also produced a number of additional recommendations:

- Establish a code of research ethics in the *process* of research;
- Publish papers contingent on successful replications; and
- Use new techniques to detect questionable research practices.

These discussions also produced suggestions for a research agenda that NSF might pursue to improve scientific replicability:

- Methodological research to improve scientific replicability;
- Research to validate candidate best and questionable research practices;
- Replications of important research findings; and
- Empirical research to test the effectiveness of the intervention strategies to improve replicability.

The workshop concluded with the thanking of all of the participants and an outline of the next steps. First, the Subcommittee on Replicability will report on the workshop at the spring, 2014 meeting of the SBE Advisory Committee (AC). After consideration of the discussions and recommendations from the workshop, the Subcommittee will address its original charge in a full report to the SBE AC at its fall, 2014 meeting. Once the report is finalized and formally accepted by the AC, it will be made public on the NSF website.

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January 12, 2016

To: AAAS Board Chair Gerald Fink, President Geraldine Richmond, CEO and Publisher of Science
Rush Holt, AAAS Board and Council Members and Colleagues:

From: Lloyd Etheredge ¹

Re: **A Code of Journalistic Ethics for Science; Recruiting an Outstanding Editor-in-Chief**

This memorandum outlines the case for AAAS to adopt a journalistic code of ethics for Science similar to the Boston Globe standard (discussed below and informing the recent movie, Spotlight). Your support for a professional code of ethics will help to recruit a new Editor-in-Chief of Science of the highest caliber. AAAS has conducted a damaging national experiment, across several decades in an increasingly politicized Washington environment, to operate Science without such a code. It is time to look at the evidence and to re-learn system-level lessons about the wisdom of an independent and vigilant press and its vital role to maintain the accountability, integrity, and performance of institutions like the National Science Foundation. In this perspective, the Editor-in-Chief job at Science is one of the most important jobs in the world.

Science and the Experiment of Silence

As a nation, we built a trustworthy system for scientific progress: academic tenure at universities, the National Science Foundation as an independent agency, guarantees for Scientific Merit, independent, peer-review awards. However, NSF secretly ended the standard of Scientific Merit, peer-review awards for the social sciences and, since the Great Society years, has curtailed lines of investigation that might challenge conventional wisdom or political agendas. One brutal cost of the *de facto* Too Hot to Handle list has been to impose, on Americans and billions of people worldwide, a stagnation of economic science (problems, known for many years, that are documented by the Congressional Budget Office data that I brought to your attention in "The Optimistic Case for Rapid Learning Economics," pp. 1-2.) ¹

¹ Lloyd Etheredge is Director of the Government Learning Project at the Policy Sciences Center, Inc. a public foundation created in New Haven, CT by Harold Lasswell, Myres McDougal and George Dession in 1948. URL: [REDACTED]

Science made a policy decision (without public disclosure) to remain silent. This has been a sore point for social scientists. We needed – and I believe that we deserved - accurate reporting in Science to defend our rights and build a well-informed movement to continue scientific progress. People assumed that, if our complaints were legitimate, Science would have sounded the alarm. Former AAAS President David Hamburg addressed these issues in a meeting with senior NSF officials under the auspices of his Carnegie Commission on Science, Technology, and Government: the enclosed letter from the former Editor-in-Chief of Science Donald Kennedy documents his awareness of this Commission engagement and a decision – reaffirmed several times by CEO Alan Leshner and Senior Editorial Boards of Science – to remain silent.² [My incoming letters had urged Kennedy to reconsider this silence, for example in the light of the use of linear regression applied to quarterly historical data by econometricians. Too much data was being lost and, in a changing world, future equations would become less reliable without a quick fix being available.]

The Boston Globe Standard

For the country and the world, a better model is the Boston Globe professional standard in Spotlight. The sexual abuse of children by trusted Catholic priests was a very different betrayal but the same principles of journalistic independence, duty to the public, and ethics apply and they produce needed change. In earlier years the Boston Globe remained silent because the Catholic Church was a powerful and important institution that brought benefits to people in Boston. At first, the Boston Globe also believed that: 1.) Violations were rare and the acts of isolated individuals; and 2.) Catholic Church officials in Boston honored, at least at their highest levels, a compelling obligation to ethical values and to victims and moved swiftly and responsibly to solve any problems. When he began to learn the truth, the Boston Globe's Editor made the right journalistic decision: Don't get into "cat fights" about individual cases, go after the institution, the system level, and the people at the top. Now, with the lives of Americans and billions of people worldwide injured by unreliable NSF economic science and a multi-decade suppression scandal with full knowledge and complicity at the top, it is time for similar investigative reporting.

Even if NSF's programs and moral credibility cannot be restored quickly, we urgently need honesty and candor so that Trustees of research universities, foundations, and philanthropists can be alerted to replace public funds for social science. There is a compelling ethical obligation to inform other nations

(about 60) who are members of the Global Research Council about the undisclosed and unexpected political lockdowns of NSF macroeconomics research, still continuing in 2016, so that they, too, can compensate and act in their own best interest.

Investigative Journalism by Science: Further Cases

There are other, cumulative, red flags at NSF that are candidates for investigative reporting by Science. Aside from normal waste, fraud, and abuse, the productivity of the national science budget, the nature of our non-profit universities, the incentive systems of science, and (potentially) the moral credibility of scientific self-governance are being damaged. The problem is that, when NSF (uniquely among Washington scientific institutions) ended its commitment to Scientific Merit, peer-review grants, it attracted armies of paid consultants and lobbyists to exploit its weakness.

1.) Hucksterism and Non-Performing NSF Grants: The Big Short

During the George W. Bush Administration, people who wanted a larger share of NSF's multi-billion-dollar budget used the same strategy that was underway on Wall Street. The current movie, The Big Short, shows how hucksters combined highly rated, trustworthy AAA home mortgages into "derivative" packages with less reliable elements. At NSF, the Scientific Merit ratings became the new AAA front-end of a "Merit" NSF package, secretly adjusted by adding "junk" political pay-off grants without a reliable rating system. [The NSF Director no longer allows Congress and the public to "buy" a Scientific Merit grant program.] The National Science Board (that brought the ethics of Texas politics to NSF) went even further: rather than require academic institutions to cost-share in new scientific facilities and Centers (a traditional rule to assure more reliable performance), the National Science Board ordered NSF to remove its cost-sharing requirements. This is the equivalent of Wall Street arranging to add No Money Down, No Monthly Payment mortgages into derivatives with the AAA mortgages.

I have raised these questions in the enclosed letter to President Geraldine Richmond in her dual capacity as a member of the National Science Board. As soon as Science adopts the Boston Globe standard, and secures answers to these questions, I expect the moral credibility of the NSF "Merit" system to collapse. The best analyst in The Big Short warned that complex, confusing, and opaque systems were red flags for exploitation, corruption, and unreliability. NSF's stonewalling suggests that the NSF Director and National Science Board (including Dr. Richmond) already know what the answers are.

2.) "Big Profit" Incentives and System-Level Damage

"Institutional flaws are best prevented, because they are hard to fix. Once an institutional structure is in place, people quickly acquire a vested interest in its preservation. The flawed structure then becomes surprisingly resistant to reform, as the US health-care system clearly demonstrates."

- Lim, Porter, Romer and Spence ³

If it applies the Boston Globe standard, Science also has a potential Pulitzer Prize and game-changing civic contribution by pursuing the disclosures in Nature (that I brought to your attention) about the sleight-of-hand system, approved by the National Science Board, to use an HHS "cut-out" and guarantee large and excessive overhead rates without individual audits. The behind-closed-doors scheme was promoted to "incentivize" university-based science and produce more rapid growth than first-ranked universities were willing to do by expanding their tenured faculty. A stack of recent books raises alarms about damaging changes at American universities. The causal pathway begins here.

Investigators are likely to find that this new Republican-era system actually has reduced the productivity of the NSF science budget. Earlier, the NSF partnership model was to buy research at the margin (with faculty salaries being paid substantially by universities through traditional teaching/tenure-track positions). The new "profit-based incentivizing" system encourages interested fast-track universities to act like shopping mall developers. The full cost of their salaries and benefits, real estate and buildings, plus generous "free money" overhead/ Profit Center payments are to be raised by non-tenure-track employees themselves through NSF grants. The "hungry mouths to feed" employment system floods NSF with grant applications (requiring about 200,000 Scientific Merit reviews/year). The only known benefit is that Administrations live well – and they have nothing at risk and it costs them nothing. [Like recent, Wall Street hustlers, the gains are privatized while the risk is shifted to the public.] Science is likely to find a growing number of safe, low-risk, and non-performing grants flooding the system, at higher cost.

One of the world's most successful (honest) investors, Warren Buffet, tells his employees: *"We must continue to measure every act against not only what is legal but also what we would be happy to have written about on the front page of a national newspaper in an article written by an unfriendly but intelligent reporter."*⁴ I think that there is a linkage across these breakdowns and red flags: It would have been best to stop these erosions quickly, when they began. Without the deterrence of public accountability via Science and the Boston Globe standard, the (likely, illegal) hucksterism and "free money" overhead payment systems helped to shift the composition, culture, and focus of attention of the National

Science Board. Instead of being a Vannevar Bush body of eminent scientific statesmen with a New England conscience, it moved toward being an accommodating coalition with for-profit institutions and interest group representatives (and encircled by skillful political actors with agendas to get around Scientific Merit awards). New members began to think of Bush-era practices as a *fait accompli* accepted by the majority. When they have conflicting interests and cannot accomplish anything alone, human beings remain silent, self-correction mechanisms weaken, and eventually an increasingly dysfunctional system has a deep and urgent need for independent, honest journalists with a Boston Globe professional standard.⁵

Attachments

- Letter from Donald Kennedy to LSE, August 4, 2006
- LSE, Letter to AAAS President and NSB Board Member Geraldine Richmond, April 9, 2015
- LSE, "The Optimistic Case for Rapid Learning Economics," November 2015

¹ There is a longer list of dead bodies and lockdowns of the use of social science for societal learning. For example, 1.) National security: the US has fought three unwinnable trillion dollar wars with the same scenario. And is beginning a fourth, still with the NSF post-Vietnam lockdown. 2.) Republican libertarian ideas still are denied an Honest Broker hearing, a stupid decision that increases Republican mistrust of science and contributes to angry, evidence-free, politics. Making the normal range of disagreements between Republicans and Democrats into a Too Hot to Handle problem has a chilling effect. 3.) The Primate Subordination Syndrome from neuroscience may contribute transformative insights into the mystery of unsolved and resistant social, behavioral, health, economic and educational problems affecting lower status human population – at least, this is possible when NSF stops treating the ideas like a potentially exploding hand grenade. 4.) NSF has had an unwritten rule against funding studies of racism and the effects of racism – and it has not had the ethics to inform universities who are trying to create incentives and careers for more Black faculty members. 5.) There are new scientific opportunities for community-based rapid learning systems to improve most state and local government programs (e.g., www.apqc.org) that do not require battles, as NSF has imagined, about the proper role of the federal government.

The deeper lesson is that Runnymede was a good idea: decisions made by truly independent peer review juries are essential. When government officials must sign-off on lines of investigation, the results – even at agencies with the earlier moral credibility and trustworthiness of NSF – soon become unsatisfactory.

² Re professional ethics and conflicts of interest: AAAS officials have unwisely chosen to hold office simultaneously on the National Science Board [e.g., President Geraldine Richmond is about to become AAAS Chairman and former CEO and Science Publisher Alan Leshner has been an NSB member for a dozen years). Since AAAS is the publisher of Science, they thereby create a chilling conflict of interest that sup-

presses candid reporting of their voting and other work in these public roles and of growing NSF problems and subterfuge policies. Understandably, the best candidates to be the new Editor-in-Chief of Science might find these dual office conflicts and the duress and chilling effects on staff news reporters to be unacceptable. It might be wise for a successful candidate to secure an entering agreement for an Ombudsman system to help resist any future Team Player pressures and, perhaps, to secure Dr. Richmond's resignation from one of her positions.

³ Edwin Lim, Ian Porter, Paul Romer, and Michael Spence, Medium and Long Term Development and Transformation of the Chinese Economy: A Synthesis Report. March 2011. (Online at www.cairncrossfund.org), p. 71.

⁴ Shira Ovide, "Warren Buffet on Ethics: We Can't Afford to Lose Reputation," The Wall Street Journal, March 31, 2011. Online: <http://blogs.wsj.com/deals/2011/03/31/warren-buffett-on-ethics-we-cant-afford-to-lose-reputation/>

⁵ The Big Short includes a scene with a Wall Street Journal reporter who remained silent. The 2008 catastrophic failure of econometric models also was a national and international failure of business-as-usual /no investigative reporting journalism.



August 4, 2006

Dr. Lloyd Etheredge, Director



Dear Dr. Etheredge,

Thanks for your letter of July 11 and for several ^{actions} ~~actions~~ that have followed. I've known for some time, both because of my services on Dave Hamburg's Commission and because you've written me from time to time, of your concern about the social, behavioral, and economic sciences at NSF and at the Academies. I don't think this is an area in which the AAAS, through its elected Board of Directors is likely to take a position. On the other hand, the News department at *Science* is always interested in issues relating to how the scientific community is served (a being treated by government or by other entities). I'm forwarding a copy of your letter to Colin Norman, the news director, so that his staff can be made aware of this concern.

With best regards,

Sincerely yours,

Donald Kennedy
Editor-in-Chief

DK/jw



THE POLICY SCIENCES CENTER, INC.

Project Director: DR. LLOYD ETHEREDGE

April 9, 2015

President Geraldine Richmond
AAAS

Dear President Richmond:

In your dual capacity as AAAS President and as a member of the National Science Board (with oversight responsibility for the National Science Foundation) would you obtain basic accountability data from NSF and publish the answer to three questions in Science within 60 days? AAAS needs to make decisions about how to restore the Scientific Merit, peer-review system. Well-informed (and perhaps confrontational) decisions, with Council and membership support, require accountability data that NSF has been unwilling to disclose.

Here are the three questions that I hope you will answer publicly:

- 1.) Comparing Outcomes. Comparing the rankings and outcomes of peer-review Scientific Merit sub-scores to the final outcomes of NSF's Merit Review competition in Washington, what difference is the new system producing? How much are we talking about? How much Scientific Merit money is NSF-Washington redistributing? What specific criteria are being given the most weight? What institutions, in what Congressional Districts, receive the largesse?
- 2.) Consistency, reliability and validity by scientific standards. By what objective measures (of consistency and reliability) do you accept the new Merit Review competition scorings of the NSF bureaucracy and senior administrators as trustworthy? And by what measures (i.e., unless you accept the declared purpose and amount of the expenditures as evidence) do you trust these new scores by NSF Director Cordova and NSF-Washington as valid scientific predictors of the actual societal benefits that this Merit system claims to produce?
- 3.) Bureaucratic Behavior and Political Censorship. The National Science Board has received concerns and evidence that NSF-Washington improperly uses its new power to censor topics in the social sciences - including Honest Broker tests of the Republican "Ayn Rand novel" theory of economics; studies of racism; potentially transformative theories from neuroscience (e.g., of an induced Primate Subordination Syndrome); new data systems to question and improve upon the

assumptions and economic science used by the Obama Administration for recovery and behavioral assumptions in Middle East politics and unwinnable wars. The political censorship issues were lost in the Leshner *et al.* Report that only described "confusion" about Merit Review and did not address issues of bureaucratic fear.

Where do things stand? Are there areas for political censorship by NSF Director Cordova and her subordinates that are currently legitimate in the eyes of NSF and the National Science Board - i.e., given that you are accountable?

Discussion

I wrote to the National Science Board on January 18, 2015 about the issues in questions 1 and 2; I enclose a copy of the letter that will remind you of the background and grounds for concern. In this Open Letter, with a request for your response in Science, may I suggest several further considerations about breakdowns and threats that the scientific community needs to engage?

- The null hypothesis of political corruption: Especially since the NSB Membership and Chairmanship of Dr. Bowen, the former President of Texas A&M, the NSF Merit Review system has evolved as a brutal zero-sum game. In reality, it quietly kills Scientific Merit awards and redistributes largesse to a certain class of universities and political constituencies by ordering bureaucrats to alter Scientific Merit rankings without public disclosure of the details. The cumulative legislative guidance of the National Science Board has grown to several dozen rules and program goal statements of favoritism and euphemisms for redistribution (e.g., "increasing participation") that are indicative of the ethics of Texas politics.¹ Behind the rhetorical flim-flam, the so-called Merit Review system of NSF-Washington biases NSF *against* Scientific Merit research awards and research applications from scientists at the nation's best universities.² This may be damaging scientific innovation and progress. There is a calculated exploitation and betrayal of the nation's research scientists who voluntarily donate 200,000 Scientific Merit reviews of 50,000 applications/year and, with trust, lend their credibility to the new NSF-Washington system. There is danger to the sterling reputation of NSF, its moral credibility, and to public support for the national science budget. There is evidence that NSF Program Officers have fought back, to retain the integrity of Scientific Merit awards, but we do not know how much damage has been done.

- About illegality and government trustworthiness: You and other members of the National Science Board do not appear, from the public record, to have been briefed about the Administrative Procedure Act of 1946. It is fundamental to public administration and to a government run by law. It has been called "the Bill of Rights of those who do business with the government" and NSF's operation of the Merit Review system (as Leshner *et al.* discovered several years ago) is illegal. There are two dozen+ NSB-legislated scoring rules and guidelines and language prescribing specific favoritism and priorities for program goals - often adopted without the required public notice or comments. The scoring in the NSF-Washington system of 50,000 competitive

grants/year must be consistent and fair and by standards that are agreed upon across judges and fully disclosed, with clarity and specificity, to all applicants and the public. The Administrative Procedure Act of 1946 also applies to independent agencies like NSF. Naming two "broad-brush" scoring categories on a Website is not even close to what federal law requires. If, by now, NSF-Washington still evades computing measures of consistency and reliability and if auditable records for the Merit Review scorings by NSF Program Officers are missing or unclear or incomplete, then everybody at NSF and the National Science Board accountable for this system must be removed, beginning at the top. In a federal agency spending \$7.8 billion/year, this is not an "Oh golly! We didn't know" problem.

The rule of law also requires that all of the cumulative legislation of the National Science Board and specific scoring guidelines in NSF documents and Web pages be codified, published, and easily accessible to everybody. We also expect a written record showing how terms are defined and applied.³

- About rhetorical obfuscation and stone-walling: If, in a democracy, full NSF transparency and disclosure can make people angry and energize political forces to over-turn policies or remove senior officials or Program Officers, then it is a civic imperative that NSF disclose the data. The Scientific Merit victims of the new NSF-Washington system whose research is being defunded have a right to be told and to organize against you. The integrity of the democratic process must be respected. This is a primary duty of the National Science Board.

- About political censorship: NSF has blocked, for more than 30 years, any Honest Broker data system to respect and evaluate the Republican "Ayn Rand novel" theory of economic growth. We have Presidents (Reagan) and Presidential campaigns with leading GOP contenders (e.g., Mitt Romney, now Rand Paul) who sincerely believe this model and the AEA-member economist and former head of the Federal Reserve, Alan Greenspan, has written a book to advocate these theories and measures.⁴ Motives of different Republicans differ (I have followed these issues for 30+ years), but one Republican perspective is that social scientists at elite institutions like Paul Krugman jeer down at Republicans, from the ramparts of NSF and the shield of an ("alleged") Scientific Merit review system run by academic liberals. If you were a Republican libertarian, and your theories were stonewalled by NSF, blocked from testing, and kept from academic social science textbooks, you would be very angry about NSF social science too. NSF-Washington and its censorship practices have been creating great trouble for the social sciences and for the country. And they are an international embarrassment.

May I suggest that the National Science Board immediately order the NSF Director to implement an Honest Broker, rapid learning system about these ideas? Commission a National Academy of Sciences/National Research Council panel to design – with full participation and the best scientific methods – the Honest Broker data system, research program, and a scientific competition modeled on the Michelson-Morley experiment in physics. Perhaps Paul Krugman will learn

something? Or Rand Paul? You can create a refreshingly better future for the social sciences, our political system, economic policy, and the country.

Yours truly,



Dr. Lloyd S. Etheredge

Cc: AAAS Executive Board, Council and Section Officers, Alan Leshner

Enclosure: LSE, Letter of January 18, 2015 to the National Science Board, with attachments.

¹ One statement of NSB legislation enacted to get around the Scientific Merit system reads: "NSF promotes broadening participation in science and engineering fields. . . . This also includes increasing diversity in the NSF portfolio with respect to types of institutions supported and the geographic regions represented." Online at http://nsf.gov/bfa/dias/policy/merit_review/facts.jsp.

² Members of the scientific community may be surprised by how NSF-Washington has been operating. For example, competitive anger was openly expressed in the NSB legislation – still on the books – that orders NSF Program Officers to censor information about institutional cost-sharing and remove it from the review process. The rule (discussed in my earlier letter), passed by administrators and former administrators from a certain kind of university, was intended to divert NSF awards from our nation's best universities that were able, and willing, to put their own funds at risk behind new projects and to raise other money to make a project a success. [In these cases your answer to question 1 cannot measure the effects of the rule, but would you list the cases where this censorship of applications has been applied?

As you will recognize the international Principles of Scientific Merit review were written to block this kind of "participation in science" corruption. Nobody disputes the right of Congress to appropriate scientific research money legally *as pork barrel politics* but – since the Congressional processes can be blocked by Congressmen from competing constituencies – this is seldom tried in science. The political corruption occurs when frustrated university members of the National Science Board exceed their legal authority and seek to manipulate a trusted, competitive scientific grants award process in a public agency.

³ This includes, for example – assuming a scale of 0 to 100 with up to 60 points awarded for Scientific Merit - whether a Program Officer applying the "geographic distribution" rule behind closed doors in NSF-Washington adds up to 3 points, or up to 30 points, when NSF and NSB language designates this as an "important" goal that it encourages.

⁴ At one level, many psychologists and most people probably agree with this idea about strong and healthy individuals. I.e., as an "if . . . then" proposition, people's lives will work better if they come from a framework of responsibility. They will be more motivated, think about what they are doing, and make better decisions than if they think of themselves as victims or wait for somebody to give them something that is missing. Individual lives will work better and so will the economy. The challenging social science question is how this personality-system dynamic is linked, if at all, by various people to public dramas of citizen-government relations and successful economic policy and to other system-level dynamics in the 21st century?

THE POLICY SCIENCES CENTER, INC.

Project Director: DR. LLOYD ETHEREDGE

January 18, 2015

Dr. Dan Arvizu, Chair and Members

Dear Dr. Arvizu and National Science Board Members:

NSF's moral legitimacy is based on the reality and perception of a politically-independent, peer-review Scientific Merit system. I hope that you will return to this system. I write to recommend that the National Science Board seek a wider range of legal opinion about NSF's changed system, now with revisions described in Press Release 14-163 of December 3, 2014 (attached).¹ This letter brings to your attention three legal barriers to what NSF is doing.

[One of these three legal barriers (# 2, below) concerns the failure of the NSF Director and her senior management teams to meet government legal standards for consistent and fair scoring, by criteria that are fully and clearly disclosed in advance, for 49,000+ applications/year. The inference that a disqualifying problem exists is based on strong *prima facie* evidence assembled by a private contractor for the National Science Board. On the basis of this evidence (discussed below, with excerpts attached to this letter), I ask you to provide the American Association for the Advancement of Science's Council, prior to its meeting next month, with standard metrics showing NSF's current achievement for standards of consistency and quality control and the actual decision algorithms, scoring, and weights that NSF is using (and their variability). The null hypothesis is that NSF has been mismanaging its new scoring system, abusing its discretionary power, failing to keep complete, auditable records and standard metrics of consistency, ignored the legal and ethical requirements for its new system, and broken faith with the scientific community.]

1.) Problems Of Missing Expertise. As described in the December 3, 2014 Press Release, NSF's changed system uses its employees to alter peer-reviewed Scientific Merit competitive rankings and awards based on their predictions of a project's contributions to broad program goals of "the national health, prosperity and welfare; or to secure the national defense." You may not do this. Federal law requires that competitive grant or contract awards be judged, with consistency and reliability, by civil servants with established and recognized expertise to make the judgments. There may be specific exceptions but, in general, NSF's employees only have established and recognized expertise to make judgments of Scientific Merit (i.e., with doctorates in their field).²

- I note this legal barrier also because (as discussed in the following section) this high-minded "program goal" rhetoric about Broader Impacts belies the reality of NSF's politicized system for forecasting

and scoring Broader Impacts. NSF's actual Broader Impacts system includes numerous "specific, desired societal outcomes," a cumulating universe of many scoring rules, interest group favoritism, and competing, lobbyist-promoted theories (often, doubtful) about how to achieve the high-minded goals.

2.) Problems of Consistency. Federal law expects government agencies to achieve consistency in their competitive evaluation of grants and contracts and to disclose their scoring system (clearly, fully and in detail) in advance to all applicants. However, no NSF Director has ever demonstrated that the new ratings by Program Officers and higher officials achieve consistency by accepted metrics. To the contrary: in 2011 the National Science Board commissioned a private contractor to do a preliminary study (based on self-reports and survey research) of whether inconsistency, unreliability, and unfairness problems existed, because it was "*aware of persistent anecdotal reports about confusion related to the Broader Impacts criterion, and inconsistency in how the criterion was being applied.*"³ The attached (confirming) excerpts from the Report present the best available evidence from NSF's own senior managers (when they were offered anonymity) about how the applications from the nation's research scientists and universities actually have been treated by a trusted scientific institution.

[Normally, with such alarming evidence, the National Science Board - as NSF's Board of Directors - would be expected to act with due diligence and commission an immediate independent, direct audit of the actual scoring and to demand standard metrics to monitor NSF compliance with legal expectations. For example, these could include inter-judge consistency established by training programs and monitored by frequent quality-control samples tested against rankings of independent Expert judges).]

However, insoluble difficulties may arise because NSF's actual Broader Impact scoring formally requires Program Officers and their superiors to award points and weights for "the achievement of specific, desired societal outcomes."⁴ An examination of NSF's new scoring system shows that almost everybody who supports the national science budget has been promised that their goals and interests are "specific, desired societal outcomes." Lobbyists, behind closed doors, also have quietly and cumulatively secured restrictive rules to achieve competitive advantages. The NSF system, egregiously, dumps all of the promises, and many of the contradictory and competing demands of a pluralist political system, onto the desks of the civil service. Program Officers are unfairly placed under duress and can be criticized, if there is transparency and accountability, for the conflicting promises of their superiors and specific scores and weights Program Officers are revealed to assign to different societal outcomes and group interests.

For example:

- A new Program Officer evaluating competing proposals, including a proposal from Texas A&M for a new Center for Excellence, will [in addition to a.) Required Scientific Merit scoring issues] discover a universe of different Broader Impact scoring instructions from your National Science Board - e.g., that b.) A "*primary goal* [sic] of NSF is to expand the participation of individuals and institutions," coded language that traditionally means that he/she should add points and tilt in favor of peripheral institutions like Texas A&M. Also, there will be guidance from NSF superiors that its Program Officers should be mindful of balanced portfolios across many dimensions, including c.) A "geographic distribution" of awards - a euphemism that, again, could enjoin an added

score for Texas A&M's application. However the Program Officer also will find a requirement to achieve "balance" by using d.) "Manpower needs" to score and weight applications, a countermove in the politics of the national science budget and coded language that typically means that peripheral Texas A&M applications must generically be ranked lower than the applicants from leading research universities who use NSF grants to hire Research Assistants and pay for the education of more, and possibly better, future research scientists.⁵

- Similarly: An honest professional assessment of whether Texas A&M just wants the money, or is genuinely committed to building a Center for national excellence, might include the scoring criteria of whether Texas A&M is putting any of its own money at risk. However the Program Officer will encounter a restrictive National Science Board rule that e.) He/she may not ask cost- and risk-sharing questions when scoring the merit of proposals from different institutions.⁶ Or, again: if Texas A&M claims that the new Center's work will contribute discoveries that can benefit economic growth, the Program Officer will find another scoring rule that f.) Claims about the benefits of limited projects in lines of scientific investigation can only be judged in the aggregate: thus, the absence of persuasive evidence for applicant claims about Broader Impacts cannot be used to disbelieve the claims when a Program Officer assigns merit scores for Texas A&M for this dimension.^{7 8}

- Alternatively, g.) An experienced Program Officer could interpret all of the rhetoric about Broader Impact and new scoring rules as mere political posturing, blowing smoke at Congress and interest groups whose votes are being sought for the NSF budget. When sophisticated Program Officers are not told what weights and scoring calibrations to use, nor required to keep complete and auditable records of the algorithm, scores, and weights, nor asked to achieve consistency, they may infer a message that they are expected to keep faith with research scientists. I.e., to continue giving Scientific Merit awards with, at best, only a light sprinkling of pixie dust to shift the final list, at the margin, if there is a highly visible case or possible complaint. NSF Directors may be perceived by career Program Officers to operate a political, "Don't Ask, Don't Tell" regime that is designed to get money.

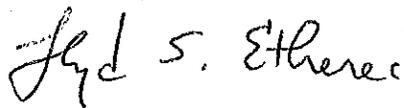
3.) Incomplete and Misleading Disclosures. This previous section (2.) illustrates why the NSF's changed system, as revised in December 2014, will not meet legal tests for transparency, good faith disclosure, and accountability. Specifically: the Press Release discloses that the NSF Director has added the evasive maneuver and option to ask Principal Investigators to participate in writing NSF's new published justifications for their awards (i.e., which, apparently, will be broad-brush and only verbal). You may not do this. NSF's actual internal decision algorithms (as illustrated above) include definitions, rules, objective and discretionary — and potentially controversial - scoring, and weights that, as a general rule, will be unknown to individual Principal Investigators. NSF is a government agency: it may not out-source its explanations to 49,000 applicants of how its new system for national competition has decided winners and losers.

NSF's Abuse of Power and Unwritten Rules.

I have brought other civic and legal issues, concerning NSF's abuses of its discretionary authority and violations of the international Statement of Principles of Scientific Merit Review, to your attention earlier. Notably NSF also has unwritten rules to avoid criticism and high-minded program goals that are defined, secretly and *ad hoc*, to restrict academic freedom and the civic role of universities and effect prior censorship by imagining future controversy that might occur. For example - its acknowledged formal legal requirement to promote economic well-being notwithstanding - NSF has, for 30+ years, neutralized testing of key Republican claims about economic behavior. These and other missing variables have been recognized to undermine the scientific integrity, reliability, and interpretation of NSF-funded research and to be a failure to apply the best available scientific methods. The NSF system -including the current NSF Director and her "senior management teams" - also has over-ridden Scientific Merit and national economic well-being criteria recommended by its own expert (Committee of Visitors) advisers and terminated progress in economic science, at a time when the lives of billions of people are being damaged by unreliable scientific theories. Trustworthy stewardship and a defining commitment to scientific progress and reliable scientific theory was, once, the primary goal of NSF's design (by Vannevar Bush *et al.*) and the foundation of its moral legitimacy.

I note that AAAS's CEO and our President-elect both are current members of the National Science Board. I hope that they can be of assistance to secure, for the AAAS Council's meeting, the consistency metrics and true full disclosure of decision algorithms and Program Officer variability, by which the Council can, applying the null hypothesis after several years, judge whether scientists have a basis for confidence in NSF's Director and the new NSF system. The National Science Board also may, with a wider range of independent legal opinion, wish to make the same judgment.

Yours truly,



Dr. Lloyd S. Etheredge, Project Director

Attachments:

- National Science Foundation, National Science Foundation Updates Transparency and Accountability Practices. Press release 14-163, December 3, 2014.
- National Science Board, National Science Foundation's Merit Review Criteria: Review and Revisions (2011), pp. 9, 34-35.

Endnotes

¹"National Science Foundation Updates Transparency and Accountability Practices," Press Release 14-163. December 3, 2014. Online at

http://www.nsf.gov/news/news_summ.jsp?cntn_id=133533&org=NSF&from=news.

² Reliable competitive evaluations (e.g., of economic impact) are challenging even for experts using the best available scientific methods.

³ National Science Board, National Science Foundation's Merit Review Criteria: Review and Revisions. NSB/MR-11-22, December 14, 2011 (Washington, DC: National Science Foundation, 2011), pp. online at <http://www.nsf.gov/nsb/publications/2011/meritreviewcriteria.pdf>

⁴ National Science Foundation, NSF Grant Proposal Guide, NSF 15-1, December 26, 2014. Chapter III - NSF Proposal Processing and Review, online at http://www.nsf.gov/pubs/policydocs/pappguide/nsfl5001/gpg_3.jsp.

⁵ Dr. Cora Marrett, "The Merit Review Process: Ensuring Limited Federal Resources are Invested in the Best Science," section on Developing Funding Recommendations. Testimony to the House Committee on Science, Space, and Technology; Subcommittee on Research and Science Education. July 26, 2011. Online without page numbers:

http://www.nsf.gov/about/congress/112/cm_meritreview_110726.jsp

⁶ National Science Board, Investing in the Future: NSF Cost Sharing Policies for a Robust Federal Research Enterprise, August 3, 2009. NSB-09-20. Online at <http://www.nsf.gov/pubs/2009/nsb0920/nsb0920.pdf>, *passim*. Also, any information about an institution's willingness to share costs should be pre-censored and removed from applications and "NSF should prohibit voluntary committed cost sharing in all components of both solicited and unsolicited proposals" Recommendation 6. This earlier National Science Board dominated by non-elite, development-oriented universities passed the guidance that "equal competitiveness" should be part of NSF's new, politicized decision system: "Although no quantitative analysis is available, the Board suggests . . . that voluntary committed cost sharing can foster unequal competitiveness among grantee institutions based on their ability and willingness to contribute cost sharing resources to NSF-sponsored projects." p. 11.

⁷ "If the size of the activity is limited [sic], evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project." NSF Grant Proposal Guide, NSF 15-1, December 26, 2014. Chapter III - NSF Proposal Processing and Review. http://www.nsf.gov/pubs/policydocs/pappguide/nsfl5001/gpg_3.jsp.

⁸ The December 2014 Press Release and NSF's public relations plan to justify its awards by reference to high-minded, distant goals is somewhat puzzling. Program Officer ratings of most projects' long-term contributions to economic well-being, national security, etc. appear to be prohibited.



**National Science Foundation's
Merit Review Criteria:
*Review and Revisions***

December 14, 2011

- Many believed that the broader impacts criterion has changed how people think about the scientific process, but that assessing the effectiveness of broader impacts would be more meaningful if they were aggregated at a higher level than the individual project.
- With respect to assessment of outcomes, there was agreement that current methods for assessing intellectual merit are adequate (publications, etc.). On the other hand, the data suggested that the methods for assessing the outcomes from broader impacts are unclear and inconsistent across projects and institutions. There was a strong sense that NSF should be doing more to facilitate assessment of whether or not the goals of the Broader Impacts criterion are being realized.
- A large majority of stakeholders believed that institutions could do more to support the PIs' efforts related to meeting the Broader Impacts criterion. For example, institutions could facilitate the establishment of connections -- among PIs engaged in similar activities, or between PIs and established programs or organizations with similar interests, etc., -- coordinate assessment activities, or provide other types of supporting services that could enhance the PI's efforts.

- The Broader Impacts criterion calls researchers' attention to the role of their work in society.
- The Broader Impacts [criterion] is wonderful in that it asks the question about what's the context in which the Intellectual Merit takes place, how do we strengthen the value of research?

The Broader Impacts criterion and/or expectations are not clear.

In nine interviews, leaders expressed the concern that the Broader Impacts criterion is vague, and that proposers and reviewers struggle to find a common understanding or evaluation metric. Leaders' statements included:

- The Broader Impacts criterion is interpreted very differently by the different communities. There is a higher bar in some communities than in others. If your research will affect other sciences, that's a broader impact in some communities. Often panelists don't pick up on the fact that this is a new principal investigator or a member of an underrepresented minority. Panelists don't understand that *that* is a part of Broader Impacts.
- The weakness of the Broader Impacts criterion is that it is mysterious to people; it is not understood by principal investigators, perspective principal investigators, or panelists.
- The criteria for deciding what is a good broader impact were never well defined – everyone has struggled with it. It is like a big fuzzy ball.
- [The vagueness of the Broader Impacts criterion] causes confusion because the community thinks that specific things need to be described for the criterion; reviewers and some program officers also think that.
- There is a general misconception it has only to do with education or of getting more women/minorities into STEM (Science, Technology, Engineering, and Mathematics) fields.
- Broader Impacts are seen as a “moving target” – there is frustration among principal investigators that they have to develop a Broader Impacts plan and they don't know how best to do that.

In three interviews where leaders raised concerns about the clarity of the Broader Impacts criterion guidance, leaders suggested that the lack of clarity can result in proposers viewing the potential considerations for the Broader Impacts criterion as a checklist. Their statements included:

- People get confused in that the areas for Broader Impacts are like a shopping list. Principal investigators wonder if they have to address all [potential considerations] on the list or just one or just some. Young faculty especially sees it as a checklist.
- If you look at the bullets [potential considerations] under the criteria, you see that they cover a wide range of topics. What happens is that principal investigators and sometimes program officers don't really know whether or not it is important to address all the bullets.
- There are many different ways to get broader impacts. There is some feeling in parts of the community that different pieces of Broader Impacts are more important than others, that you are supposed to deal with all of it, and if you don't deal with all considerations at a higher level, you're not doing the job.

There are ways the Broader Impacts criterion could be clarified.

In five interviews, officials made some suggestions for improving the Broader Impacts criterion, most related to clarifications and instructions, such as:

- Add “consistent with the scope of your project.”
- Add examples specific to a program.

- Add "improve international collaboration".
- Carefully articulate what NSF means by "Broader Impacts", and perhaps state some flexibility as to how much some awardees are expected to respond vs. other awardees.
- Give the Broader Impacts criterion a better umbrella definition so that people understand that the potential considerations are just examples.

1 *Weighting of Intellectual Merit Criterion and Broader Impacts Criterion*

Reviewers have difficulty evaluating and/or weighting Broader Impacts criterion potential considerations.

In four interviews, NSF Leaders indicated that while reviewers are typically well qualified to evaluate the Intellectual Merit criterion, they are not consistently able to effectively evaluate the Broader Impacts criterion. The leaders suggested that reviewers have a very hard time comparing different types of Broader Impacts, saying things such as:

- Reviewers are frustrated that they don't have the expertise to compare working with a high school class vs. developing a museum exhibit vs. working with an HBCU [Historical Black Colleges and Universities]. They can only look at whether it seems reasonable.
- It is hard for reviewers to give the Broader impacts criterion a clearly objective set of evaluative criteria - how do you compare a proposal that includes graduate students with one that includes a partnership with a museum?

Reviewers and principal investigators place more weight on the Intellectual Merit criterion than on the Broader Impacts criterion.

Also in four of the interviews, leaders mentioned that they see reviewers and proposers weight the Intellectual Merit criterion more heavily than the Broader Impacts criterion, making statements such as:

- Broader Impacts statements are sometimes seen as a "tie-breaker" or as a way to pick one proposal over the other.
- Leaders hear: "If we are going to fund something it has to have intellectual merit; then we look at the broader impacts."
- People have problems weighting the two criteria. They have heard that the weighting is often 80/20, Intellectual Merit to Broader Impacts. There is no rule about this but Intellectual Merit is the driving force for most reviewers -where this is a strength or a weakness depends on the proposal.
- The default with many proposals is that they describe research and then add a little paragraph that has to do with their graduate students, or they will talk a bit about what they plan to do with respect to outreach. The main issue has to do with the lack of understanding by the people who write proposals, the reviewers, and also the staff at NSF. There is not a very sophisticated understanding of what a broader impact can be. You get a cookie cutter approach - principal investigators just throw a piece in.

Press Release 14-163. December 3, 2014. [Online at http://www.nsf.gov/news/newssumm.jsp?cntn_id=133533&org=NSF&from=news]

National Science Foundation updates transparency and accountability practices

At the November National Science Board (NSB) meeting, National Science Foundation (NSF) Director France A. Cordova outlined the agency's new approaches to enhancing transparency and accountability, including a revision to the agency's guidelines for program officers and providing regular updates on the agency's transparency and accountability web page.

"Good stewardship of public resources requires ongoing examination of our processes and continuous improvement," **Cordova** said. "We will continue to convey the significance of our science and engineering research in supporting the national interest. To do this we must clearly communicate our funding rationale publicly."

The guidelines for program officers in the Proposal and Award Manual now state that a nontechnical project description must explain **the** project's significance and importance and "serve as a public justification for NSF funding by articulating how the project serves the national interest, as stated by NSF's mission: to promote the progress of science; to advance the national health, prosperity and welfare; or to secure the national defense." The titles and abstracts of NSF's awards are made public on NSF.gov.

"NSF is committed to communicating to the American public how grants awarded for fundamental research are selected through external review based on their merit and their promise to fulfill NSF's mission," said NSB Chair Dan Arvizu. "It is important to clearly explain through award titles and abstracts how the research in which NSF invests results in new discoveries and innovations, enhanced prosperity, and the preparation of the next generation of scientists and engineers."

NSF also has provided to program staff new guidelines and training for writing award abstracts and titles. The agency, **Cordova** said, also has taken steps to reinforce roles and responsibilities of division directors and program officers related to the merit review process.

On Dec. 26, 2014, NSF's Proposal and Award Policies and Procedures Guide for principal investigators (Pis) will be updated to include the following statement: "Should a proposal be recommended for award, the PI may be contacted by the NSF Program Officer for assistance in preparation of the public award abstract and its title. An NSF award abstract, with its title, is an NSF document that describes the project and justifies the expenditure of Federal funds."

STATEMENT OF PRINCIPLES FOR SCIENTIFIC MERIT REVIEW*



Preamble

Research funding agencies worldwide identify and support scientific research that creates new knowledge and benefits society. Trusted with government funding, these agencies are publicly accountable for their funded research efforts. As stewards of the public trust, these institutions must demonstrate excellence in the assessment of proposed research and be responsive to program objectives. Rigorous and transparent scientific merit review helps to assure that government funding is appropriately expended on the most worthy projects to advance the progress of science and address societal challenges.

The rapid growth of research and education capacity worldwide is enabling unprecedented opportunities for global collaboration to expand scientific knowledge and to improve the quality of life and well-being of citizens. To foster collaborations and to realize the benefits of international cooperation, the following Principles for Scientific Merit Review are endorsed at the May 2012 Global Summit on Scientific Merit Review.

Principles

Expert Assessment

Collectively, reviewers should have the appropriate knowledge and expertise to assess the proposal both at the level of the broad context of the research field(s) to which it contributes and with respect to the specific objectives and methodology. Reviewers should be selected according to clear criteria.

Transparency

Decisions must be based on clearly described rules, procedures and evaluation criteria that are published *a priori*. Applicants should receive appropriate feedback on the evaluation of their proposal.

Impartiality

Proposals must be assessed fairly and on their merit. Conflicts of interest must be declared and managed according to defined, published processes.

Appropriateness

The review process should be consistent with the nature of the call, with the research area addressed, and in proportion to the investment and complexity of the work.

Confidentiality

All proposals, including related data, intellectual property and other documents, must be treated in confidence by reviewers and organizations involved in the review process.

Integrity and Ethical Considerations

Ethics and integrity are paramount to the review process.

* The terms Merit Review and Peer Review are used interchangeably in the context of this document.

CODE of ETHICS

PREAMBLE

Members of the Society of Professional Journalists believe that public enlightenment is the forerunner of justice and the foundation of democracy. Ethical journalism strives to ensure the free exchange of information that is accurate, fair and thorough. An ethical journalist acts with integrity.

The Society declares these four principles as the foundation of ethical journalism and encourages their use in its practice by all people in all media.

SEEK TRUTH AND REPORT IT

Ethical journalism should be accurate and fair. Journalists should be honest and courageous in gathering, reporting and interpreting information.

Journalists should:

- ▶ Take responsibility for the accuracy of their work. Verify information before releasing it. Use original sources whenever possible.
- ▶ Remember that neither speed nor format excuses inaccuracy.
- ▶ Provide context. Take special care not to misrepresent or oversimplify in promoting, previewing or summarizing a story.
- ▶ Gather, update and correct information throughout the life of a news story.
- ▶ Be cautious when making promises, but keep the promises they make.
- ▶ Identify sources clearly. The public is entitled to as much information as possible to judge the reliability and motivations of sources.
- ▶ Consider sources' motives before promising anonymity. Reserve anonymity for sources who may face danger, retribution or other harm, and have information that cannot be obtained elsewhere. Explain why anonymity was granted.
- ▶ Diligently seek subjects of news coverage to allow them to respond to criticism or allegations of wrongdoing.
- ▶ Avoid undercover or other surreptitious methods of gathering information unless traditional, open methods will not yield information vital to the public.
- ▶ Be vigilant and courageous about holding those with power accountable. Give voice to the voiceless.
- ▶ Support the open and civil exchange of views, even views they find repugnant.
- ▶ Recognize a special obligation to serve as watchdogs over public affairs and government. Seek to ensure that the public's business is conducted in the open, and that public records are open to all.
- ▶ Provide access to source material when it is relevant and appropriate.
- ▶ Boldly tell the story of the diversity and magnitude of the human experience. Seek sources whose voices we seldom hear.
- ▶ Avoid stereotyping. Journalists should examine the ways their values and experiences may shape their reporting.
- ▶ Label advocacy and commentary.
- ▶ Never deliberately distort facts or context, including visual information. Clearly label illustrations and re-enactments.
- ▶ Never plagiarize. Always attribute.

MINIMIZE HARM

Ethical journalism treats sources, subjects, colleagues and members of the public as human beings deserving of respect.

Journalists should:

- ▶ Balance the public's need for information against potential harm or discomfort. Pursuit of the news is not a license for arrogance or undue intrusiveness.

- ▶ Show compassion for those who may be affected by news coverage. Use heightened sensitivity when dealing with juveniles, victims of sex crimes, and sources or subjects who are inexperienced or unable to give consent. Consider cultural differences in approach and treatment.
- ▶ Recognize that legal access to information differs from an ethical justification to publish or broadcast.
- ▶ Realize that private people have a greater right to control information about themselves than public figures and others who seek power, influence or attention. Weigh the consequences of publishing or broadcasting personal information.
- ▶ Avoid pandering to lurid curiosity, even if others do.
- ▶ Balance a suspect's right to a fair trial with the public's right to know. Consider the implications of identifying criminal suspects before they face legal charges.
- ▶ Consider the long-term implications of the extended reach and permanence of publication. Provide updated and more complete information as appropriate.

ACT INDEPENDENTLY

The highest and primary obligation of ethical journalism is to serve the public.

Journalists should:

- ▶ Avoid conflicts of interest, real or perceived. Disclose unavoidable conflicts.
- ▶ Refuse gifts, favors, fees, free travel and special treatment, and avoid political and other outside activities that may compromise integrity or impartiality, or may damage credibility.
- ▶ Be wary of sources offering information for favors or money; do not pay for access to news. Identify content provided by outside sources, whether paid or not.
- ▶ Deny favored treatment to advertisers, donors or any other special interests, and resist internal and external pressure to influence coverage.
- ▶ Distinguish news from advertising and shun hybrids that blur the lines between the two. Prominently label sponsored content.

BE ACCOUNTABLE AND TRANSPARENT

Ethical journalism means taking responsibility for one's work and explaining one's decisions to the public.

Journalists should:

- ▶ Explain ethical choices and processes to audiences. Encourage a civil dialogue with the public about journalistic practices, coverage and news content.
- ▶ Respond quickly to questions about accuracy, clarity and fairness.
- ▶ Acknowledge mistakes and correct them promptly and prominently. Explain corrections and clarifications carefully and clearly.
- ▶ Expose unethical conduct in journalism, including within their organizations.
- ▶ Abide by the same high standards they expect of others.

The SPJ Code of Ethics is a statement of abiding principles supported by additional explanations and position papers (at spj.org) that address changing journalistic practices. It is not a set of rules, rather a guide that encourages all who engage in journalism to take responsibility for the information they provide, regardless of medium. The code should be read as a whole; individual principles should not be taken out of context. It is not, nor can it be under the First Amendment, legally enforceable.

CONTACT THE SOCIETY

For more information on the Society of Professional Journalists or for more on journalism ethics, visit SPJ's website at spj.org or contact SPJ at:

Society of Professional Journalists • Eugene S. Pulliam National Journalism Center
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Improving & Protecting Journalism



Michael, Jennifer

From: Becky Sheetz-Runkle <[REDACTED]>
Sent: Thursday, January 21, 2016 3:32 PM
To: [REDACTED]
Subject: PR: Savitz, Vice Chair of President's Council Appointed to CRDF Global Board of Directors

January 20, 2016
Becky Sheetz-Runkle
For Immediate
Release
[REDACTED]

Media Contact:
[REDACTED]

CRDF Global Adds Science and Technology Luminaries William Colglazier, Tomas Diaz de la Rubia and Maxine Savitz to its Board of Directors

ARLINGTON, VA—CRDF Global announced today the additions of Dr. E. William Colglazier, Dr. Tomas Diaz de la Rubia and Dr. Maxine Savitz to its Board of Directors. They each bring extensive experience in CRDF Global program areas as well as in many of the more than 40 countries where it works. CRDF Global is an independent nonprofit organization that promotes international scientific and technical collaboration through grants, technical resources, training and services.

Dr. E. William Colglazier is Visiting Scientist and Senior Scholar in the Center for Science Diplomacy at the American Association for Advancement of Science (AAAS) and works to support science diplomacy and international cooperation in science and technology. He is also editor-in-chief of the AAAS Center for Science Diplomacy's quarterly *Science & Diplomacy*. He served as Science and Technology Adviser to the Secretary of State from 2011 to 2014. Prior to that, he served as Executive Officer of the National Academy of Sciences and the National Research Council. He's a past Associate Director of the Program in Science, Technology, and Humanism of the Aspen Institute of Harvard University and was Professor of Physics at the University of Tennessee. He has a Ph.D. in theoretical physics from the California Institute of Technology.

Dr. Tomas Diaz de la Rubia is Purdue University's Chief Scientist and Executive Director of Discovery Park. Dr. Diaz de la Rubia formerly served as Innovation Leader and Director in Deloitte's energy and resources industry practice. He's a former Chief Research Officer and Deputy Director for Science and Technology at the Lawrence Livermore National Laboratory. He has published more than 150 peer-reviewed articles and has co-edited several books and conference proceedings. He is a fellow of the American Physical Society and AAAS and holds a doctorate in physics from The State University of New York, Albany.

Dr. Maxine Savitz is Vice Chair of the President's Council of Advisors on Science and Technology. She is former Deputy Assistant Secretary for Conservation, U.S. Department of Energy. Prior to that, she was Program Manager for Research Applied to National Needs at the National Science Foundation. In the private sector, she was President of Lighting Research Institute, Assistant to the Vice President for Engineering at The Garrett Corporation, General Manager of Allied Signal Ceramic Components and General Manager for Technology Partnerships at Honeywell. Dr. Savitz served two terms as Vice President of the National Academy of Engineering, was an American Academy of Arts and Sciences Fellow and was appointed to the National Science Board. She received her Ph.D. in Organic Chemistry from the Massachusetts Institute of Technology.

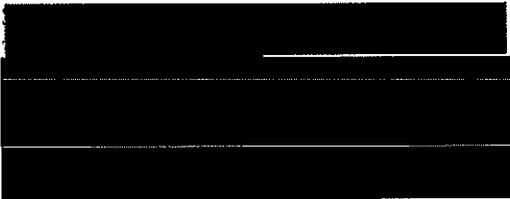
The new board members began their terms in January 2016 and each serve for a four-year term. "Bill, Tomas and Maxine are great additions to the CRDF Global board and their experience and expertise will greatly benefit our board and further our mission of peace and prosperity through international collaborations," said Paul Longworth, Chair, CRDF Global Board of Directors; Vice President, International Environmental / Nuclear, Fluor Corporation. "Each of their career accomplishments is extraordinary, and we are excited about the contributions they will make to our effort to create opportunities for scientists and innovators to make the world a better place," said Longworth.

About CRDF Global

CRDF Global is an independent, nonprofit organization established in 1995 to promote international scientific and technical collaboration through grants, technical resources, training, and services. CRDF Global has nearly 20 years of experience managing international research funding programs and supporting emerging science and technology infrastructure in more than 40 countries in Eurasia, the Middle East, North Africa and South Asia.

###

Becky Sheetz-Runkle



[REDACTED]

From: Samantha Minor <[REDACTED]>
Sent: Monday, February 22, 2016 1:19 PM
To: [REDACTED]
Cc: [REDACTED]
Subject: Samantha Minor
Sacramento Capital Region Advanced Manufacturing Press Release
Attachments: Advanced Manufacturing PR .pdf

MEDIA RELEASE

For Immediate Release
February 22, 2016

For information contact

Trish Kelly | [REDACTED]
Theresa Milan | [REDACTED]

Advanced Manufacturing Shows Future Job Growth in the Sacramento Capital Region

SACRAMENTO, CA – The advanced manufacturing sector directly and indirectly employs more than 42,000 in the six-county Sacramento Capital Region and contributed more than \$12.4 billion in economic output in 2014, according to a new report released today by Valley Vision, the region’s civic leadership organization.

The *Advanced Manufacturing Cluster: Workforce Needs Assessment* is the first of six reports to be released by Valley Vision that updates economic data for the high growth business clusters originally identified in the Next Economy Action Plan, which was adopted by over 20 local governments and dozens of business groups three years ago.

The new research was funded through a grant from JPMorgan Chase & Co. and is being executed by Valley Vision, Los Rios Center of Excellence, and Burriss Service Group. In December 2013, JPMorgan Chase launched a \$250 million, five-year workforce readiness initiative – *New Skills at Work* -- to help close the skill gaps in sectors where employers struggle to fill vacancies and to assist job seekers access the education and training required for those positions. A key component of the program is focused on research that provides actionable data to better understand the dynamics of labor markets.

“JPMorgan Chase is pleased to be part of the task force in Sacramento that is aiming to train people for today’s jobs,” said Kari Decker, JPMorgan Chase Managing Director of Corporate Responsibility for the Western Region. “We made this investment because, again and again, our business clients from around the globe, and locally here in the Sacramento region, have been telling us that they’re struggling to find job applicants with the skills they need to fill their positions. This is especially true for middle-skill jobs such as computer technology, nursing and advanced manufacturing. By building a bridge between employers, job seekers, educators and training providers, we believe the skills gap can be closed, resulting in greater economic opportunity and prosperity for all.”

The new findings show the Advanced Manufacturing cluster had more than 16,000 jobs in 2014, representing 42% of all manufacturing in the region. With several subsectors, the cluster’s competitive advantage lies within the transportation and machinery subsectors. The region shed nearly 1,800 jobs during the peak of the recession, but started rebounding in 2010. By 2019, the cluster is projected to add as many as 755 new jobs overall, but an examination of total job openings (new and replacement jobs including due to retirements) shows advanced manufacturing is projected to add more than 2,500 jobs across 15 high-demand occupations.

Advanced Manufacturing is a high value cluster for the region with a large multiplier effect, meaning the cluster directly and indirectly benefits the overall economy. The cluster contributed more than \$12.4 billion in economic impact in 2014, and employs roughly 42,000 in this region.

During a recent forum at Sierra College, industry experts, economic developers, workforce agencies, and educational and training institutions reviewed the report findings and provided additional input on high priority skills gaps and regional assets. A panel of cluster employers identified workforce challenges such as an aging workforce, not enough supply of skilled workers to fill open positions, millennials wanting to work in “cool” high paying companies such as tech firms, and current applicants having no hands-on experience as engineers. The information gathered from this and upcoming cluster forums will be prioritized to create a regional workforce action plan, which will be released in May 2016 at a major workforce summit.

Additional reports in Life Sciences and Health Services, Informational and Communication Technologies, Education and Knowledge Creation, Food and Agriculture and Clean Economy will be rolled out sequentially throughout the first half of 2016. The Advanced Manufacturing cluster report, along with the other forthcoming cluster reports, can be found on the Valley Vision Website by clicking www.valleyvision.org. The information gathered from this and upcoming cluster forums will be prioritized to create a regional workforce action plan, which will be released in May 2016 at a major workforce summit.

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About JPMorgan Chase & Co.

JPMorgan Chase & Co. (NYSE: JPM) is a leading global financial services firm with assets of \$2.4 trillion and operations worldwide. The Firm is a leader in investment banking, financial services for consumers and small businesses, commercial banking, financial transaction processing, and asset management. A component of the Dow Jones Industrial Average, JPMorgan Chase & Co. serves millions of consumers in the United States and many of the world's most prominent corporate, institutional and government clients under its J.P. Morgan and Chase brands. The firm uses its global resources, expertise, insights and scale to address some of the most urgent challenges facing communities around the world including the need for increased economic opportunity. Information about JPMorgan Chase & Co. is available at www.jpmorganchase.com.

Now celebrating its 22nd year, **Valley Vision** is a civic leadership organization that provides independent research and leadership support for break-through initiatives that improve the region's economic, social, and environmental vitality.

The **Los Rios Community College District's Center of Excellence**, in partnership with business and industry, delivers regional workforce research and labor market trends to help northern California's 15 community colleges respond through program changes and grants.

The **Burriss Service Group (BSG)** is a full-service economic development-consulting firm founded by Bob Burriss in 2015. BSG provides research and advisory services in economic development, management, strategy and real estate for public agencies and institutions, private companies and non-profit organizations.

MEDIA RELEASE

For Immediate Release

February 22, 2016

JPMORGAN CHASE & CO.



Connect. Partner. Impact.

For information contact

Trish Kelly | [REDACTED]

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[REDACTED]

From: Michael Kasprow [REDACTED]
Sent: Monday, February 01, 2016 7:20 AM
To: FN-OSTP-PCAST
Subject: support the Oxitec field trial in Florida

Monday, 01 February, 2016

Dear sir or madam:

Please facilitate the Oxitec field trial in Florida.

I believe the USDA has greater expertise/experience than the FDA in assessing this mosquito control modality. Indeed, less non-target species would be impacted than using insecticides.

Genetic sterilization techniques such as the Oxitec trial would send mosquito-borne diseases (e.g. Zika, malaria, Dengue, etc.) on a path much like vaccination programs impacted polio, and smallpox.

Eight months have passed since FDA promised last May to publish for public comment a routine environmental assessment of the Oxitec field trial. Progress is halted until the FDA reviews the comments. This delay is unnecessary and unconscionable.

Best regards,

Michael Kasprow

[REDACTED]

From: Barb Olson [REDACTED]
Sent: Saturday, January 09, 2016 7:17 PM
To: FN-OSTP-PCAST
Subject: PCAST Hearing Report September 2015
Attachments: PastedGraphic-1.pdf

Dear PCAST Leaders,

I recently watched Dr. Christine Cassel's webcast and read your report on *Aging America & Hearing Loss: Imperative need of Improved Hearing Technology*. I was thrilled by your report. I concur with all of the reports finding from my past research and current small PSAP business experience.

I saw this need, studied the market and the consumer and started *Simple Ear* two years ago. We take the highest quality digital hearing aids in the US and preprogram them with a prescription that is common to 85% of the typical aging population. We then sell them to consumer for \$400- \$750 per unit (rather than \$2400 - \$4000 per unit with a custom prescription from an audiologist.) We allow customers to try them for 60 days risk free and fully refund their money if they are not helpful. We direct consumers with a severe hearing problems to an audiologist. We offer an online hearing test developed by a PhD. We are fully in line with PCAST directional recommendations outlined in your report. We are unique in that we have the highest quality products made in the US and are sincerely trying to offer consumers an affordable solution for mild to moderate hearing loss. Find us at www.simpleear.com

Here is my ask from you:

- 1) Will you forward this email to your committee, especially those participating and interested in your September 2015 report. I want them to be aware of Simple Ear. (We are the real deal, not a cheap amplifier)
- 2) I would love to have a conversation with the PCAST leaders developing your follow up report.

Thank you for your attention.

Sincerely,

Barbara Olson
[REDACTED]
[REDACTED]

[REDACTED]

From: Carol Mone [REDACTED]
Sent: Tuesday, February 09, 2016 1:11 PM
To: FN-OSTP-PCAST
Subject: Metrification

Hello Science, Technology, Engineering and Math people!

I keep waiting for the United States to adopt the SI. Remember in the 1970s when suddenly all the road signs had km equivalents posted next to the miles? The gas station in my tiny town of Trinidad [population about 400] even listed prices per liter of gas. Everything looked like we were going to at least give a nod to the measurement system used throughout the world. Except maybe Liberia and Myanmar [but they have probably gotten on board, too] the entire world runs on the SI. Apparently we are too resistant to come along with the others and play nicely.

I have worked most of my career as a school teacher and I cannot tell you how many kids got confused by how many feet in a meter or how many ounces in a liter. Could we just make it easy for them? Could we actually encourage kids to consider science, engineering and technology by not making the math measurement part so complex? Would it be feasible to start small—my two largest confusions are temperature and distance. Celsius makes complete sense. The National Weather Service could just switch over, offering a Fahrenheit conversion for a few years until the dinosaurs die. And distances. Miles make no sense whatsoever—to anybody. And memorizing how many yards or feet or meters in a mile [meters is the easiest!] is a waste of brain space. Why not just convert road distances and weather? What needs to be done to make this change? What happened last time when it all looked like the change was upon us? An entire generation has gone by confused about just about everything having to do with measurement, due to our refusal to join the rest of humanity in measurement. what can I do before I die to see a road sign with a km equivalent?

Thank you.

Carol Moné
[REDACTED]

[REDACTED]

From: Lloyd Etheredge [REDACTED]
Sent: Wednesday, February 10, 2016 12:57 AM
To: [REDACTED]
Subject: NSF's Self-Correction Report
Attachments: 2016.0209.NSFSelfCorrectionPlan.pdf

Dear PCAST's Co-Chairs and Members:

Billions of people will continue to be injured until there is more reliable economic science.

In 2015 NSF published a self-correction plan to produce more reliable Social, Behavioral and Economic Sciences. I enclose a copy, with comments, for your review. For economic science, the NSF plan is useless and deeply misleading about the scientific and institutional nature of the problems and the very hopeful options to solve them quickly. In early 2016, the cumulative evidence is that NSF's senior leadership and National Science Board members cannot be trusted - even though it is their responsibility - to solve the problems of economic science.

In this light, the enclosed communication urges you to convey this conclusion, with ideas for system-level and scientific remedies, swiftly to President Obama.

On a personal note: I hope that you will design and implement system-level corrections.<1> After too many years at this, I would not recommend relying upon individual scientists, who can be maneuvered into positions of being isolated whistle blowers.

A reference copy of my "The Optimistic Case for Rapid Learning Economics" in online at >www.policyscience.net<.

Just to repeat my concern: **Billions of people will continue to be injured until there is a more reliable economic science. NSF cannot be trusted to solve the problem. We urgently need your leadership and leadership from other system-level actors.**

Lloyd Etheredge

<1> A watchdog press - at Science, for example - is a wise, system-level element that helps to deter eroding standards. Now, individuals at senior levels must be held accountable and replaced, but this will not be enough.

Dr. Lloyd S. Etheredge, Project Director
Policy Sciences Center, Inc.

[REDACTED]

The Policy Sciences Center is a public foundation that creates and develops knowledge and practice to advance human dignity.

It was founded in 1948 in New Haven, CT by Harold Lasswell, Myres McDougal, and George Dession, members of the Yale

faculty. Information about the Center, the Society of Policy Scientists and the Policy Sciences journal is available at

>www.policyscience.org<.

[REDACTED]

From: Grant Millin [REDACTED] >
Sent: Friday, February 26, 2016 5:02 PM
To: FN-OSTP-PCAST
Cc: [REDACTED]

Subject: North Carolina PCAST "Technology and the Future of Cities: City Web" demonstration

Dear PCAST, White House cabinet members, and White House council directors and staff,

Concerning the recent announcement by the President's Council of Advisors on Science and Technology, I have a *Technology and the Future of Cities: City Web* demonstration I would like to collaborate with the White House on. Because I am a person with high functioning autism I had to work incredibly hard to make a career for myself. At age 50 I have done everything I could.

As you look over the evidence of this City Web solution, keep in mind I am working on a technology demonstration connecting this use of Citrix Podio with the DOE *Quadrennial Technology Review*; the DOE / National Laboratories Grid Modernization Initiative; the National Association of Clean Air Agencies *Implementing EPA's Clean Power Plan: A Menu of Options*; and FERC's *Guidance Principles for Clean Power Plan Modeling* with Duke Energy's Western Carolina Modernization Project; which is one of the only large new generation programs of Duke Energy's right now.

I have been awarded a Petition to Intervene in the corresponding NC Utilities Commission docket. In my submittal I requested open collaboration with government, Duke Energy, and community stakeholders in developing a supporting NC Clean Power Plan.

While I agree a City Web need not be "operated monolithically" and having "no central authority to control innovation" has some merits, I would conversely say opening innovation and opportunity ecosystems to more parties ready to succeed in hard work requiring principles and excellent strategy. At the micro level teaching individuals new sustainability innovation knowledge and techniques is hard and requires very good supporting policy and innovation management. So I created a professional development initiative called Sustain NC that fosters sustainability innovation.

Key elements of Sustain NC and Open Strategic Innovation linking to PCAST City Lab needs

I am an honorably discharged Navy veteran. I would be very, very proud to work with the White House. Here's my *Open Strategic Innovation for Communities (OSIC)* overview:

><http://www.innovograph.com/projects/osic/><

This is an overview of how I use Podio apps:

Using InnovoGraph Open Strategic Innovation (OSI) on Podio

<http://www.innovograph.com/wp-content/uploads/2016/02/Using-InnovoGraph-OSI-on-Podio-v2.1.pdf>

Within Urban Development Districts, across regions and states, and at national and global levels, some Unified Communications and Collaboration (UCC) system is need. Podio, which is a Citrix (GoToMeeting) product, has a great track record and has a free account option just like Facebook or Twitter. I consistently ask Podio executives to make sure the free option stands and no credit card is requested, even after 30 days or a year. The problems with having a group like MIT CoLabs build a solution like Podio include a lot of time passing.

I hope the US Government uses the solution I've already set up.

By the way, the phrase UCC is missing from this otherwise excellent PCAST report. I would also add that big data and heavy computational capability should be on separate, but connected platforms. Otherwise City Web will deploy slowly and there will be too much involved for decision makers and citizens in need. There are many, many people—especially decision makers—but also folks like me who are trying to join or rejoin the economy who benefit by being 'Future of Work' ready, or Future of Work leaders like I am... or could be with a breakthrough that uses my talents at least.

Our recent NCSU Institute for Emerging Issues *FutureWork* convention covered these matters during: <https://iei.ncsu.edu/futurework/>. For whatever reasons IEI will not engage with me in a significant manner. Because I am not already successful and am offering a breakthrough solution, and am in the 'innovation pits'.

I actually have a good model to describe my own challenge and those other are suffering these days:

InnovoGraph Innovation and Opportunity Ecosystem (IOE) Model:

<https://drive.google.com/file/d/0B37AIGuzkOl-eTM1X1FyX0NpZzA/view?usp=sharing>

While City of Asheville is making preparations to start up their first physical innovation district, my solutions go unused here. Unfortunately after a meeting two years ago with Mayor Manheimer and City Manager Gary Jackson I was told the COA IT director would have to set up an RFP outlining my already prepared solution. I asked Gary to simply join the NC Digital Divide Leap workspace that folks were joining at the time. I won't repeat what Gary said, but it was disappointing.

I hope PCAST appreciates Sustain NC: <http://sustainnc.com>. Here's the service model: <http://sustainnc.com/about/service-model/>.

Here's the Sustain NC *Smart Grid DEEP / Smart Cities and Towns Strategy Map*: <http://sustainnc.com/wp-content/uploads/2015/06/Sustain-NC-Strategy-IG-SGDEEP-v1.1.pdf>

Next, I look forward to talking about a program around this National Academy of Sciences Earth Lab exhibit:

Earth Lab: Degrees of Change

<http://secondstory.com/project/earth-lab>

KSM Mitigation Simulator

<https://www.koshland-science-museum.org/explore-the-science/interactives/mitigation-simulator><

I hope to work with the White House soon. I am extending a gift invitation to join Sustain NC for President Obama and North Carolina Governor McCrory.

I am copying Jerry Miller, past OSTP Assistant Director for Ocean Sciences and Director of the NAS Science and Technology for Sustainability Program. I find many corollaries between the Sustain NC demonstration; the 2013 NAP *Sustainability for the Nation: Resource Connection and Governance Linkages* report; City Web; and the challenges of launching the NC Clean Power Plan.

Ref.

PCAST Releases Technology and the Future of Cities Report to the President

<https://www.whitehouse.gov/blog/2016/02/23/pcast-releases-technology-and-future-cities-report-president>

Best wishes,

Grant Millin, Innovation Strategist and Owner
InnovoGraph LLC - Strategic Innovation Services and Management Consulting

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Email: [REDACTED]

URLs: www.innovograph.com / www.sustainnc.com<

AboutMe Page: <http://about.me/grantmillin><

InnovoGraph makes strategic innovation work.

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[REDACTED]

From: Lloyd Etheredge <ll[REDACTED]>
Sent: Wednesday, February 17, 2016 2:24 PM
To: [REDACTED]
Subject: PCAST & Reliable Science: Architect of 2008 Bailout Says US Banks Still Pose "Nuclear" Threat to Economy

Dear PCAST Co-Chairs and Members:

The following news story "**Architect of 2008 Bailout Says US Banks Still Pose 'Nuclear' Threat to Economy,**" underscores my concern that President Obama's economic advice is based on our nation's sub-optimal social science research capabilities. It may be dangerously wrong about both the optimistic upside and the dangers.

Since 2008 economic scientists in the Obama Administration have not fully honored the "show your work" and other disclosure standards for reliable science in their economic forecasting and financial sector "risk" analysis. I've brought to your attention the CBO data for two-year GDP forecasting record of government and other modelers since the late 1970's: it's getting worse, and it is unlikely that the people arguing about risk and 'nuclear' threat have better models - e.g., everybody still has the same missing variables and simplifying assumptions.

The official Administration position is that the science-based work in its programs is trustworthy. However, Neel Kashkari probably is right: E.g., I have seen no evidence that the Treasury Department and Federal Reserve know how to model individual and institutional psychological reactions in system-level panic.

- For financial sector modeling, the NIH rapid learning standard would be a system-level upgrade for everybody: Public domain "cloud" data system and analysis tools, "Everything Included," pre-populated and curated at public expense, with free, 24x7 access.

The President has to put a lot more science on these issues. I hope that PCAST will warn him and recommend an end to sub-optimal capabilities. And the necessity to arrange media events at Brookings.

LE

Architect of 2008 bailout says US banks still pose 'nuclear' threat to economy

The Guardian. February 16, 2016. by Rupert Neate.

America's biggest banks present a "nuclear" threat to the US economy and should be broken up, a Federal Reserve policymaker and architect of the 2008 banking bailout said Tuesday.

Neel Kashkari, the head of the Minneapolis Federal Reserve, said the US's biggest banks were still "too big too fail" and Congress should consider "bold transformational solutions to solve this problem once and for all".

"I believe the biggest banks are still too big to fail and continue to pose a significant, ongoing risk to our economy," Kashkari said in his first public speech since becoming a Fed policymaker in January. "A very crude analogy is that of a nuclear reactor. The cost to society of letting a reactor melt down is astronomical. Given that cost, governments will do whatever they can to stabilize the reactor before they lose control."

Kashkari, who is best known for organising the \$700bn government-funded bank bailout in 2008, said "serious consideration" should be given to "breaking up large banks into smaller, less connected, less important entities". Another solution, he said, was to turn the big banks into public utilities by "forcing them to hold so much capital that they virtually can't fail".

He said existing measures under the 2010 Dodd-Frank financial reform law designed to prevent another banking system collapse do not go far enough and warned that "we won't see the next crisis coming".

"The financial sector has lobbied hard to preserve its current structure and thrown up endless objections to fundamental change," said Kashkari, who was previous an executive at Goldman Sachs and former Republican politician. "The time has come to move past parochial interests and solve this problem. The risks of not doing so are just too great."

Kashkari's comments, in a speech to the Brookings Institution thinktank in Washington, come as presidential candidates battle over whom has the best solution to prevent another banking crisis, and prevent a repeat of the economic collapse.

Vermont senator Bernie Sanders, who is taking on Hillary Clinton for the Democratic presidential nomination, has called for a break-up of big banks and the introduction of a new financial transaction tax to pay for free college education.

"There are lines in your speech I can imagine a Bernie Sanders or Elizabeth Warren saying," David Wessel, a former journalist who moderated the Brookings event, told Kashkari during a panel discussion after the speech. "It's not what one expects."

Kashkari responded that he was calling things as he saw them.

"If I'm not willing to stand up and share my concerns, then I wouldn't be doing my job," he said.

Dr. Lloyd S. Etheredge, Project Director
Policy Sciences Center, Inc.



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[REDACTED]

From: Rick Eulo [REDACTED]
Sent: Tuesday, March 01, 2016 4:14 PM
To: [REDACTED]
Cc: [REDACTED]
Subject: Smart Cities
Importance: High

Dear Ms. Blumenthal:

Our company, IDC Research, Inc. provides IT Research and Advisory Services to government and industry backed by over 1,100 analysts worldwide.

We recently noted in a news report in State Scoop that your team had released a report on Smart Cities. This [article](#) and its focus describe an effort from your team that aligns directly with a significant practice area of our research and analysis, a global practice we launched in 2011 called "Smart Cities Strategies." IDC was the first firm to create a dedicated research practice focused on the creation of smart cities.

Our Research Director, [Ms. Ruthbea Clarke](#) has engaged many city leaders in her research and is a thought leader in Smart Cities. She was most recently invited to present at the NSF on the smart city ecosystem. She has been advocating the increased role of the US federal government in smart city development for the past 5 years and would like to engage your group in discussions about the possibility of bringing our in-depth research and analysis results to play in the President's efforts to improve technology at the city level.

We hope to open a conversation on how further improvements can be achieved at the local level when cultivated by the federal government. Please respond to the undersigned, or directly to Ms. Ruthbea Yesner Clarke, Research Director of the global Smart Cities Strategies program, copied on this email.

Details can be found on our website: <http://www.idc.com/prodserv/insights/government/ps/smartcities.jsp>

Thank you for the opportunity to bring our research to your attention..

V/R,

Rick Eulo
Senior Contract Manager

IDC Government Insights



IDC Government Insights mission is to provide the highest quality, best value IT research, advisory and professional consulting services to our government customers through a dedicated team devoted to our governments' needs.

From: [andrew bergwald](#)
To:



Subject: Technology, Harassment and Derangement
Date: Wednesday, March 16, 2016 7:40:00 AM
Attachments: [images.pdf](#)

Dear Sir,

Technology companies and the European Space Agency are involved in cutting edge developments and many iterative experiments which reveal new truths. These experiments involve trial and error procedures which are inspired by educated guesswork. The legal system\law enforcement is unprepared because their approach has historically been reactive to events but now needs to become more preemptively relevant to the research of technology entities to ensure it remains ethical and compliant to the principles of human rights. There has been success in regulating the pharmaceutical industry to remain disciplined but it is appropriate that other scientific bodies more actively participate in shaping what should and should not be studied. Such bodies include the ESA, Universities, Government and Private sector technology groups. As technology joint ventures expand internationally, those with power who care, need to give informed leadership globally. I have suffered for 13 years in precisely the same way that it subsequently emerged that those with neurological, mind reading fascination are also Satellite, communications experts while authorities twiddled their thumbs. I have recently written that government inefficiency is challenged in a technological era and today it was reported Google wants only national laws(i.e. not state by state) for its driverless cars. Why do authorities believe the existence of driverless cars and not remote mind interference? Nationwide driverless cars will also simplify road planning and that is the next layer of bureaucrats to become obsolete. If it is good enough for Google, it is good enough for victims whose human rights have been totally ignored and violated! It should be the Government wakeup call because if they don't care, noone else with influence will while all these creeps pursue these perverted realities. The attachment is from Norwegian Airlines March 2016 in flight magazine and an apparently more informed source than government. To many technology buffs, this stuff is cool and Isis threats against Mark Zuckerberg are appropriate for the same recklessness.

><http://www.bbc.com/news/magazine-35786771><

For example, it is apparent that despite banning embryonic stem cell research there is little to stop the work of Indian doctor Dr. Geeta Shroff from lucratively entering the global mainstream industry.

>https://www.google.co.th/webhp?source=search_app&gws_rd=cr,ssl&ei=TuznVq36BdGouOTprq2QBg<#q=geeta+shroff

Yours Sincerely
Andrew Bergwald

Future

Transhumanists and biohackers use the latest technologies to enhance their bodies and minds. Are they playing with fire by playing god, or just 10 years ahead of the rest of us?

Words/Sarah Warwick → Photos/David Vintiner

It sounds like the plot of a sci-fi film. Man wants to become cyborg. Man pays doctor to fuse an antenna to a bone in his skull. Man discovers he can perceive colours that are invisible to other people. Man connects his head to the internet, and even receives colours from outer space.

If this was a movie, something terrible would probably happen at this point – an alien attack, perhaps, or some horrendous disease caused by brain radiation. But in fact, not only has Neil Harbisson, the man who really did have an artificial device attached to his head a decade ago, not suffered any ill effects, he's now set up a company to sell similar add-ons to others.

Amazingly, it seems there may even be a market for this unusual business. Harbisson is just one of a growing number of people who are experimenting with using futuristic technologies to enhance their minds and bodies.

Known as “grinding” or biohacking, the trend for this kind of experimentation dates back to the 1990s, when UK professor Dr Kevin Warwick surgically inserted a computer chip into his arm. In 2002, he became the world's first cyborg, after having part of a robotic arm embedded in his.

Since then the movement has grown and expanded. Would-be hackers can now buy DIY implants online, including computer chips that allow them to open doors with just their hands. Others use chemical eye drops that enable night vision; »

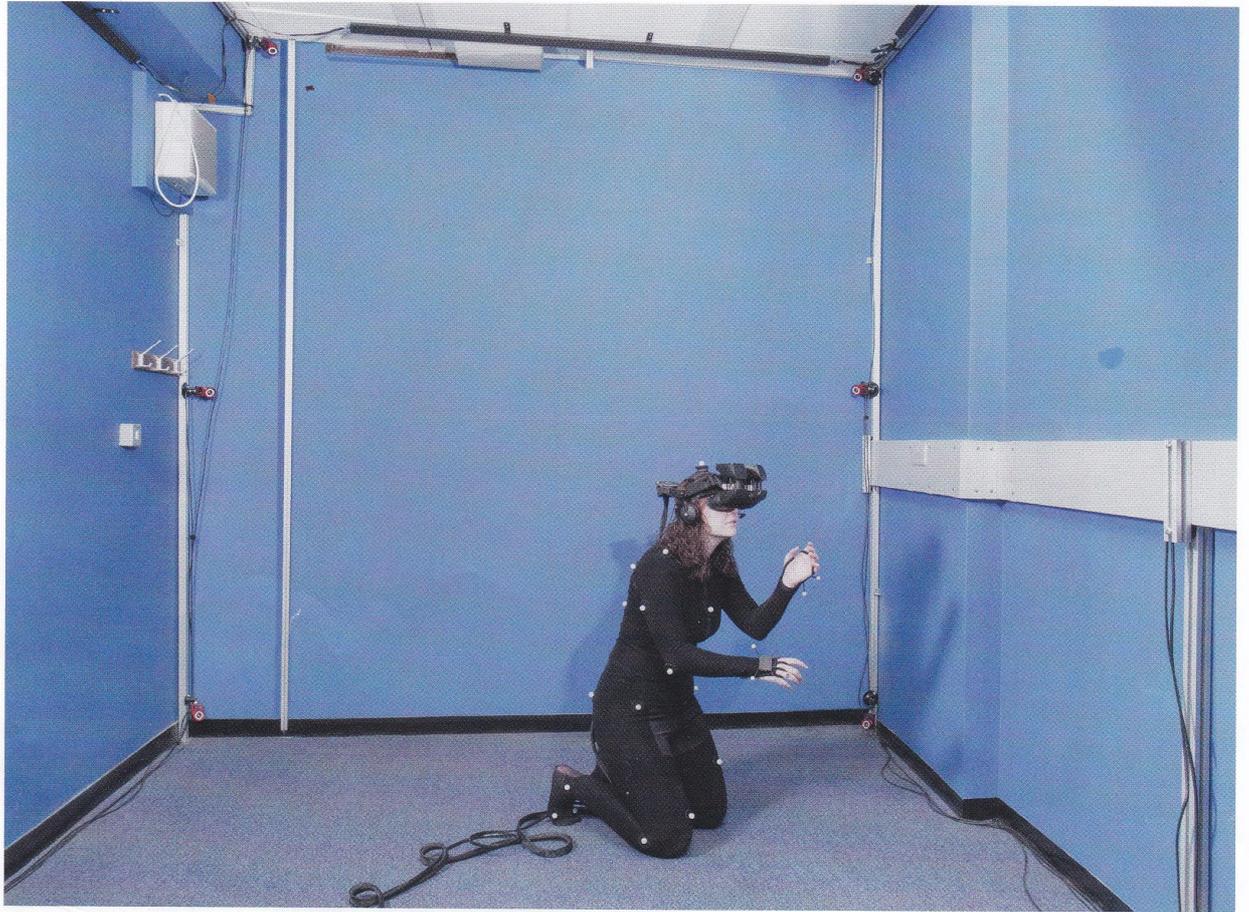
people



Neil Harbisson

"I'VE HAD AN ANTENNA for over a decade now and it would be weird not to have one," says Neil Harbisson. The British-born artist was born without the ability to see colour – a disability that his cybernautic implant allows him to circumnavigate. "It allows me to perceive colour through vibrations in my head that become sounds in my ears," he says. "At the very beginning the aim was to perceive visual colours, but it has allowed me to see ultraviolet and infrared too." Harbisson uses his new sense to make art, making him the world's first cyborg artist. He now wants to inspire more people to join

him in extending their senses. "People haven't realised how important that is. If we could extend hearing to infrasound, below 20Hz, for example, we could communicate with elephants, or sense a tsunami coming." To him, his situation is similar to that of transsexuals in the 1950s and '60s. "Then people who wanted a sex change needed to find people willing to do it anonymously. It's the same with cyborg operations, which aren't generally accepted by bioethics committees. There are obviously risks, but if we don't start exploring the technology ourselves, we'll never know."



“We’re only beginning to understand what embodiment means to the brain. When you embody an avatar, it changes your cognition”

Dr Caroline Falconer

“WE’RE ONLY BEGINNING to understand what embodiment means to the brain,” says Dr Caroline Falconer, a research fellow with MindTech and the University of Nottingham who researches the use of virtual reality (VR) avatars in mental healthcare. “Some studies have shown that if you’re white and you embody a black avatar then this could reduce your racial bias. When you embody a child, it changes your cognition to be more childlike.” Her latest study looks at the potential effect this effect has on levels of self-compassion, which are linked to depression. “We had participants embody

an adult avatar... trying to comfort a crying child. They then become the child they just tried to comfort, so they get to experience their compassionate response from the child’s perspective.” Her initial results showed a decrease in depressive symptoms in most participants, with the effects lasting for a month or more. She hopes further testing will prove VR to be a useful therapeutic tool. “It’s a great platform to really look at the self in a safe and controlled way,” she says. “How the self interacts with technology can help us understand how the self is represented in the brain.”



Andrew Vladimirov

"I'VE ALWAYS BEEN INTERESTED in enhancement," says the Russian-born scientist, who practises neural stimulation with low-intensity magnetic fields, using what is known as a "God Helmet". "If something makes you more productive – then why not?" While writing his doctoral thesis he worked on performance-enhancing drugs, but now he prefers to experiment with electrostimulation. "It's easier than trying to design drugs at home because you can monitor results properly," he says. "Another advantage is that you can stimulate the whole brain, or you can choose

one part over another. If you want to focus on the right temporal lobe, say, it could make you more creative; if you favour the left then you get into a different state where you're very, very active. I remember not being able to sleep for nearly a week after one such session." As the voltage used is only as much as that in a pair of headphones, the process doesn't hurt. "People do make mistakes but it's not possible to cause pain. I know now it all looks like sci-fi but look at human history and you think how much we achieved in the last 200 years. We have to start somewhere."



Dirk Bruere

"TRANSHUMANISM IS ABOUT making people better than well," says Dirk Bruere, one of the founding members of the Transhumanist Party. "It's the technological augmentation of humanity: living longer, faster, higher, better." His view on bodyhacking is mixed: although he's tried nootropic (so-called "smart") drugs and tDCS (transcranial direct-current stimulation), both of which can temporarily boost intelligence and memory, he's nervous of some of the more extreme examples. He cites Elizabeth Parrish, CEO of biotech start-up BioViva, who claims to have injected herself with telomerase, a

genetically modified protein that's proven to extend life in animals but is completely untested on humans. "The big worry is that anything that can promote growth can also promote any latent cancers – and nobody knows. You don't just say let's inject it into a few people and see what happens." The flipside is that without brave guinea pigs, scientific process moves at a glacial pace. "Even if there already was a pill that could give you 20 years more of healthy life, you probably wouldn't have it on the streets for 15 years. This is where DIY biotech can make a big difference."

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“Humans are like walking, talking computers. We have the same electrical impulses”



Tiana Sinclair

“MY INTEREST IN FUTURISM has been nurtured since I was little,” says Tiana Sinclair, a Russian-British start-up exec whose father is a transhumanist. “Time travel was an average subject at family dinners.” Growing up with an interest in technology has helped it become both her career and her hobby. Alongside her start-up EventSlides, she writes about tech and runs Future Tech Track, an annual event “for innovators and early adopters” that helps to introduce people to new technologies, including the Neurosky MindWave brain-controlled drone (pictured). “Essentially brainwaves are

tiny electrical impulses that get released when our neurons are firing,” she explains. “The forehead sensor monitors those impulses,” which, when analysed by a computer, can be used to fly a drone. “I program the drone so when I concentrate it flies up; when I relax it drops. It just shows that humans are like walking, talking computers. We have the same electrical impulses, and it all can be analysed, recorded and quantified.” She loves that there’s such a growing interest in human-computer interactions. “It’s the most exciting time to be alive.”

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Don't try this at home... yet

Move over, Fitbit. The next wave of wearable tech is designed to be worn *under* the skin. Most devices aren't yet approved for public use but they could provide a peep at what our future selves will be using.



Measure fitness

Circadia is a smartphone-sized piece of hardware from US biotech start-up Grindhouse Wetware, which downloads blood pressure and heart rate. grindhousewetware.com



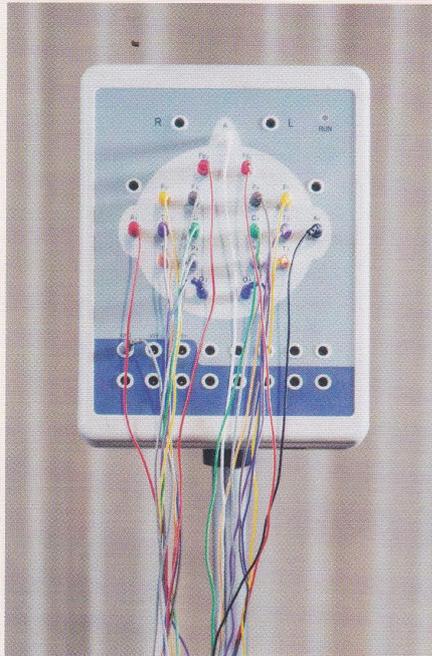
Open doors

RFID (radio-frequency identification) chips are popular within the grinding community – they allow users to unlock doors, sign into computers and share personal information. dangerousthings.com



Get an new sense

Still in its infancy, Neil Harbisson's start-up plans to offer would-be cyborgs the chance to buy sensory implants. So... would you want an antenna? cyborgnest.net



Plugging in: the outlet for Andrew Vladimirov's "God Helmet"

"It's not as far-fetched as it first seems"

run electric currents through their heads; or – like the main character in *Limitless*, a sci-fi movie from 2011 – experiment with mind-enhancing drugs.

"A lot of these things seemed very futuristic but they're happening more frequently now, and I'm sure they will increase," says David Vintiner, a photographer who has become something of an expert on the subject while working on *The Futurists*, his latest personal project.

The ongoing portrait series was inspired by the London Futurists, a 4,000-strong group who meet on a monthly basis to debate the impact of technology. His images depict various group members who take this to a far more personal, and even surgical, level.

"We've included people who can provide a strong visual story," says Vintiner, who was introduced to the group by a colleague. "It's unusual and intriguing. You're just not used to seeing someone with an antenna coming out of his head."

Aside from Neil Harbisson, the series features start-up guru Tiana Sinclair, who exercises her mind with a brainwave-powered drone; Dr Caroline Falconer, whose work involves avatar-based psychotherapy; and Dirk Bruere and Andrew Vladimirov, who have both dabbled with transcranial direct-current stimulation (tDCS) – electric currents to the brain, which are thought to temporarily boost intelligence.

Vintiner confesses that at first he found the sight of people like Harbisson somewhat shocking, however after talking to them he now understands their rationale. "One of the things I like about being a photographer is finding out what the hell people are doing and what motivates them," he says. "It's not as far-fetched as it first seems."

For transhumanists like Bruere and Vladimirov, whose aim is to help push civilisation forward by discovering processes that help people become brighter, stronger and live healthy for longer, self-experimentation is essential. Ethics committees are set up to find cures for disease, meaning that processes with the potential to make one "better than well" might take decades to develop.

If that's true, then rather than depicting an eccentric minority, these portraits could show pioneers. Might we all one day take pills to live longer, use avatars to boost confidence and communicate with other species using our sixth-sense implants? According to Vintiner, it's possible.

"We're used to seeing people with artificial limbs or hearing aid implants. Why not an antenna?"

davidvintiner.com, meetup.com/london-futurists



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