USIA Research Journal

The Journal of USIA

Partnership
Mega Foundation
Mega International

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USIA
United Sigma Intelligence Association

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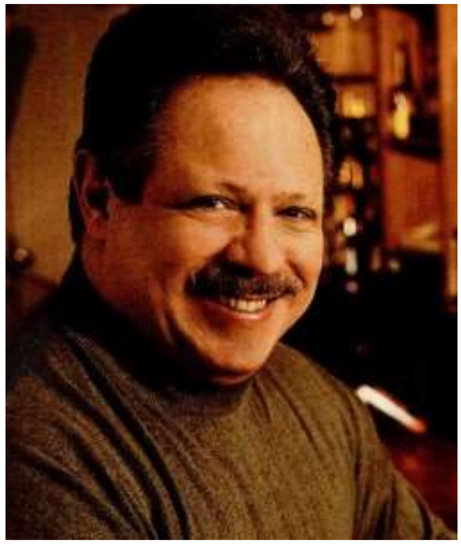
Founder, Dr. HanKyung Lee

Dr. HanKyung Lee, MD (이한경) is the Founder of the United Sigma Intelligence Association, as the first founder of high intelligence organization, in South Korea, at the cognitive level higher than the Mensa. Dr. Lee works as a Medical Doctor in South Korea, after studied Medical Science and earned a MD degree at Eulji University. For his intelligence area, Dr. Lee was the winner on the cognitive ability international competition of Culture Fair Numerical and Spatial Examination-CFNSE conducted by Etienne Forsstrom, and achieved a very high cognitive performance on the test C-09 conducted by Psychologist Dr. Xavier Jouve. Dr. Lee is the first person to attain 5 sigma score on the spatial cognitive test created by Psychologist Jonathan Wai, besides obtaining the ceiling score on a standardized intelligence test as the full scale. His personal commitments include Artificial Intelligence, Singularity, Personality Psychology and Religion among others. In respect of the domains, further, Dr. Lee's vision is to contribute to the field of Nano-Technology, and bring Strong Artificial Intelligence forward the medical application and improvement to the real world. Dr. Lee has confidence this technology sophistication would deal with a substantial number of patients suffered from physical diseases. With establishing three, four, and five sigma intelligence society for the first time, respectively, in South Korea, Dr. Lee is also a member of Olympiq Society.

President & Executive Director, Mr. YoungHoon Kim

Mr. YoungHoon Kim (김영훈) is the President and the Executive Director of the United Sigma Intelligence Association, also working as the Managing Editor of the *USIA Research Journal*. Mr. Kim studied degrees in Philosophy and Theology (Liberal) at Korea University and Yonsei University, respectively, after studied a degree in Piano Performance (classic) at a university college of music. Currently, he is in preparation to further study PhD Philosophy in the United States. Outside academic, he wrote a Mystery Novel and won the prize titled as the Award Winning Writer in South Korea. In the area of high intelligence, Mr. Kim has been a Senior Membership Officer at Mega Foundation and Mega International (Society), founded by Dr. Gina Langan, and Mr. Christopher Langan who has been called in several US media as "the smartest man in america". Additionally, he has been the Vice-President at Olympiq Society, founded by Dr. Evangelos Katsioulis who is a medical doctor and a psychiatrist also known as holding the highest adult IQ score in Europe in some media. For his Full Memberships of high IQ society includes Mega International (Formerly, Mega Society East), Omega Society, Olympiq Society, Ultranet of Mega Foundation, Epimetheus Society, Triple Nine Society, One in a Thousand Society, Top One Percent Society, and Mensa.

Executive Vice-President, Mr. Christopher Langan



Mr. Christopher Michael Langan is the Executive Vice-President and a Fellow of the United Sigma Intelligence Association. Mr. Langan is a noted independent researcher and reality theorist whose extraordinary intellect has not prevented him from living a rough, unsheltered, and exciting life. He is best known for his groundbreaking theory of reality, the Cognitive-Theoretic Model of the Universe (CTMU). The CTMU is a reflexive, tautological, and profoundly self-contained intrinsic language through which reality exists and evolves by “talking to itself about itself”, thus serving as its own theory, universe, and model. Combining physics, metaphysics, and biology in a tight, elegant, and unique logico-semiotic structure called the Metaformal System, the CTMU provides a long-sought bridge between mind and matter, science and spirituality, and the internal and external aspects of human and cosmic existence. Challenged from early childhood by extreme poverty and inadequate schooling, Chris learned young to value brawn as highly as brains. After working as a cowboy, firefighter, construction worker, and bar bouncer in various nightclubs throughout the New York metropolitan area, he came to the attention of the media in 1999 for combining one of the world’s highest IQs with limited formal education and a bare-knuckle lifestyle. Having conducted original investigations infields including logic, mathematics, physics, cosmology, biology, philosophy, language theory, theology, economics, and the cognitive sciences, he has contributed articles on such topics to a number of scholarly journals and alternative intellectual periodicals. Some of these have been collected into books, starting with The Art of Knowing in 2002. In 2017, he began publishing a series of papers that have changed the landscape of science and philosophy. The most recent, Introduction to Quantum Metamechanics, is currently in press. Mr. Langan is the co-founder and president of a non-profit organization, the Mega Foundation, which was established to offer aid, support and camaraderie to the "severely gifted," a small and neglected population with whose plight he is intimately acquainted. He has carried on his work in the high IQ community through various organizations including the Mega Foundation, Mega International, and the Ultranet, which place emphasis on not just measured intelligence, but moral integrity and creative achievement.

Senior Vice-President, Dr. Evangelos Katsioulis

Dr. Evangelos Katsioulis, MD, MSc, MA, PhD is the Senior Vice-President and a Fellow of the United Sigma Intelligence Association. Dr. Katsioulis works as a consultant psychiatrist and psychotherapist. He earned an MD, Medical Doctor Diploma (2000), M.Sc., Medical Research Technology (2003), M.A., Philosophy (2012), and PhD, Psychopharmacology (2015). Dr. Katsioulis earned the best performance in the Cerebrals international contest (2009), best performance in the Cerebrals NVCP-R international contest (2003), best performance in physics for the national final exams in Greece (1993), and third place in the Maths national contest in Thessaloniki, Greece (1989). Dr. Katsioulis writes articles, novels, and quotes including screenplays – ELLHNAS.com (2008) and TI PEI (2009). Also, he contributed to the web advertisement-management of NAMANIC.com and the web development of Charing Cross Scheme in Psychiatry (2006), Charing Cross & St Mary's Membership of the Royal College of Psychiatrists (2006), and Aristotle University of Thessaloniki – School of Medicine – General Biology Laboratory (2012). He lives in Thessaloniki, Macedonia, Greece.

Senior Director & Editor-in-Chief, Mr. Scott Jacobsen

Mr. Scott Douglas Jacobsen is the Senior Director of the USIA & Editor-in-Chief of the *USIA Research Journal*, and a Fellow of the United Sigma Intelligence Association. Mr. Jacobsen is an Independent Journalist and founder of In-Sight Publishing. He is the Secretary-General of Young Humanists International on the Executive Board. He is a Writer and Editor of its publication, Humanist Voices, and a Member of the Americas Regional Committee (Canada). He is a Board Member (British Columbia Representative) of Humanist Canada. In his previous term, he served as Treasurer/Vice-President of the International Humanist and Ethical Youth Organisation on the Executive Committee. He lives in Canada.

Senior Neuropsychologist & Senior Editor, Dr. Gina Langan

Dr. Gina Langan, PhD is the Senior Neuropsychologist**,** the Senior Editor of the *USIA Research Journal*, and a Fellow of the United Sigma Intelligence Association. Dr. Langan earned her PhD in Clinical Psychology with a minor in Biopsychology at Wayne State University. She did her post-doctoral residency in Clinical Psychology and Neuropsychology through Yale School of Medicine. Dr. Langan is the Executive Director of the *Mega Foundation*, a nonprofit organization for gifted adults. In addition to research, teaching, and consulting, Dr. Langan and her husband own a horse ranch in the Green Hills of Missouri.

USIA Fellow, Dr. Ronald Hoeflin

Dr. Ronald K. Hoeflin, PhD is the Honorary and Advisory Researcher, and a Fellow of the United Sigma Intelligence Association. Dr. Hoeflin is best known as the founder of Mega Society and Prometheus Society before founding Omega Society, Epimetheus Society, One in a Thousand Society**,** and Top One Percent Society. As an American Philosopher, Dr. Hoeflin received a PhD in Philosophy from The New School for Social Research, and in 1988, he won the American Philosophical Association's Rockefeller Prize for his article, "Theories of Truth: A Comprehensive Synthesis." Presently, Dr. Hoeflin is nearing completion of his multi-volume book titled "The Encyclopedia of Categories".

USIA Fellow, Mr. Dominic O'Brien

Mr. Dominic O'Brien, GMM is the Honorary and Advisory Memory Champion, and a Fellow of the United Sigma Intelligence Association. Mr. O'Brien is the first and the eight-time World Memory Champion**.** He is known as Multiple Guinness World Records Holder for committing to memory a random sequence of 2808 playing cards (54 packs) after looking at each card only once. Mr. O'Brien is also an author of Best Selling Books, His Best-Seller, "How to Develop A Brilliant Memory – Week by Week" ranked Number One on Amazon UK.

USIA Fellow, Prof. Peter Singer

Professor Peter Singer is the Honorary and Advisory Philosopher, and a Fellow of the United Sigma Intelligence Association. Prof. Singer is best known as "World's Most Influential Living Philosopher" credited with starting the Modern Animal Rights Movement, development of Effective Altruism, and Life Ethics in Bioethics. He is Ira W. DeCamp Professor of Bioethics at Princeton University. Since 2005, Prof. Singer has been Laureate Professor at the University of Melbourne, both in the School of Historical and Philosophical Studies.

USIA Fellow, Prof. Nick Bostrom

Professor Nick Bostrom is the Honorary and Advisory Philosopher, and a Fellow of the United Sigma Intelligence Association. Prof. Nick Bostrom is Swedish-born philosopher and polymath with a background in theoretical physics, computational neuroscience, logic, and artificial intelligence, as well as philosophy. He is a Professor at Oxford University, where he leads the Future of Humanity Institute as its founding director. (The FHI is a multidisciplinary university research center; it is also home to the Center for the Governance of Artificial Intelligence and to teams working on AI safety, biosecurity, macrostrategy, and various other technology or foundational questions.) He is the author of some 200 publications, including *Anthropic Bias* (2002), *Global Catastrophic Risks* (2008), *Human Enhancement* (2009), and *Superintelligence: Paths, Dangers, Strategies* (2014), a New York Times bestseller which helped spark a global conversation about artificial intelligence. Bostrom's widely influential work, which traverses philosophy, science, ethics, and technology, has illuminated the links between our present actions and long-term global outcomes, thereby casting a new light on the human condition. He is recipient of a Eugene R. Gannon Award, and has been listed on Foreign Policy's Top 100 Global Thinkers list twice. He was included on Prospect's World Thinkers list, the youngest person in the top 15. His writings have been translated into 28 languages, and there have been more than 100 translations and reprints of his works. He is a repeat TED speaker and has done more than 2,000 interviews with television, radio, and print media.

USIA Fellow, Prof. Graham Priest

Professor Graham Priest is the Honorary and Advisory Philosopher, and a Fellow of the United Sigma Intelligence Association. He is a Distinguished Professor of Philosophy at the Graduate Center, City University of New York, and Boyce Gibson Professor Emeritus at the University of Melbourne. Prof. Priest is known for his work on non-classical logic (dialetheism), metaphysics, the history of philosophy, and Buddhist philosophy. He has published over 300 articles—in nearly every major philosophy and logic journal—and seven books—mostly with Oxford University Press.

USIA Fellow, Dr. Aubrey de Grey

Dr. Aubrey de Grey, PhD is the Honorary and Advisory Biomedical Gerontologist, and a Fellow of the United Sigma Intelligence Association. Dr. de Grey is a biomedical gerontologist based in Cambridge, UK and Mountain View, California, USA, and is the Chief Science Officer of SENS Research Foundation, a California-based 501(c)(3) charity dedicated to combating the aging process. He is also Editor-in-Chief of *Rejuvenation Research*, the world highest-impact peer-reviewed journal focused on intervention in aging. He received his B.A. and PhD from the University of Cambridge in 1985 and 2000 respectively. His original field was computer science, and he did research in the private sector for six years in the area of software verification before switching to biogerontology in the mid-1990s. His research interests encompass the characterization of all the accumulating and eventually pathogenic molecular and cellular side-effects of metabolism that constitute mammalian aging and the design of interventions to repair and/or obviate that damage. He has developed a possibly comprehensive plan for such repair, termed Strategies for Engineered Negligible Senescence (SENS), which breaks aging down into seven major classes of damage and identifies detailed approaches to addressing each one. A key aspect of SENS is that it can potentially extend healthy lifespan without limit, even though these repair processes will probably never be perfect, as the repair only needs to approach perfection rapidly enough to keep the overall level of damage below pathogenic levels. Dr. de Grey has termed this required rate of improvement of repair therapies longevity escape velocity. Dr. de Grey is a Fellow of both the Gerontological Society of America and the American Aging Association, and sits on the editorial and scientific advisory boards of numerous journals and organizations.

USIA Fellow, Prof. Duncan Pritchard

Professor Duncan Pritchard, FRSE is the Honorary and Advisory Philosopher, and a Fellow of the United Sigma Intelligence Association. Professor Pritchard is a Chair in Philosophy at the University of Edinburgh (UK), and Distinguished Professor of Philosophy at the University of California, Irvine (US). Professor Pritchard's research is mainly in the area of Epistemology; Skepticism; Wittgenstein; Philosophy of Cognitive Science; Philosophy of Religion; Philosophy of Education; Philosophy of Law. In 2007 he was awarded the Philip Leverhulme Prize, and in 2011 he was elected to a Fellowship of the Royal Society of Edinburgh, UK.

USIA Fellow, Prof. Susan Schneider

Professor Susan Schneider is the Honorary and Advisory Philosopher, and a Fellow of the United Sigma Intelligence Association. She is a Professor at the University of Connecticut, and the NASA-Baruch Blumberg Chair at the Library of Congress and NASA. She is also the Director of the AI, Mind and Society Group at the University of Connecticut. Schneider writes about the nature of the self and mind, especially from the vantage point of issues in philosophy, AI, cognitive science and astrobiology. Within philosophy, she has explored the computational nature of the brain in her academic book, The Language of Thought: a New Direction. More recently, she defended an anti-materialist position about the fundamental nature of mind. In her new book, Artificial You: AI and the Future of the Mind, she brings these topics together in an accessible way, discussing the philosophical implications of AI, and, in particular, the enterprise of "mind design." Her work in philosophy of AI has now taken her to the Hill (Washington, DC), where she will meet with members of Congress on AI policy and organize educational events for Congress and staffers in conjunction with the Library of Congress on a range of topics, such as data privacy, algorithmic bias, technological unemployment, autonomous weapons, and more. Schneider appears frequently on television shows on stations such as PBS and The History Channel (see below for clips) as well as keynoting AI ethics conferences at places such as Harvard University and University of Cambridge. She also writes opinion pieces for the New York Times, Scientific American and The Financial Times. Her work has been widely discussed in the media, (see "media" above), at venues like The New York Times, Science, Big Think, Nautilus, Discover and Smithsonian.

USIA Fellow, Prof. Henrik Lagerlund

Professor Henrik Lagerlund is the honorary and advisory philosopher, and a Fellow of the United Sigma Intelligence Association. He is a Professor of Philosophy at Stockholm University, Sweden. He was previously Professor of Philosophy and Head of the Philosophy Department at the University of Western Ontario in Canada. Prof. Lagerlund works on the history of philosophy; primarily on Medieval and Renaissance philosophy, but he has also written on Aristotle and Leibniz. Another interest is the philosophy of food. He is at the moment writing a history of skepticism for Routledge.

USIA Fellow, Prof. Michael Rose

Professor Michael R. Rose is the Honorary and Advisory Scientist (Evolutionary Biologist), and a Fellow of the United Sigma Intelligence Association. He is a Distinguished Professor &Director of NERE, Ecology & Evolutionary Biology School of Biological Sciences at University of California, Irvine, and Chief Scientist at Lyceum Pharmaceuticals. His research interests are Experimental Evolution, Human Evolution, Evolution of Sex, and Biological Immortality in addition to Aging and Drosophila. His academic distinctions include British Commonwealth Scholar (1976-1979), NATO Science Fellow (1979-1981), NSERC of Canada University Research Fellow (1981-1988), President’s Prize (with others) American Society of Naturalists (1992), Excellence in Teaching Award, UCI Biological Sciences (1996), and Busse Prize, World Congress of Gerontology (1997).

USIA Fellow, Dr. Tom Chittenden

Dr. Tom Chittenden, DPhil, PhD, PStat is the Honorary and Advisory scientist (Statistician/Biologist)**,** and a Fellow of the United Sigma Intelligence Association. Dr. Chittenden holds D.Phil. from University of Oxford, and PhD from Virginia Tech. Presently, he is a Senior Biostatistics and Mathematical Biology Consultant at Harvard University, Medical School as an Advisory Board Member. He has been a Lecturer and Research Fellow at Massachusetts Institute of Technology (MIT), University of Oxford among others. Dr. Chittenden is the Chief AI Scientist of WuXi NextCODE Genomics, and President and Founder of Complex Biological Systems Alliance. He was recently named one of the *Top 100 Artificial Intelligence Leaders* in Drug Discovery and Advanced Healthcare. Dr. Chittenden is a member of the Omega Society.

USIA Fellow, Dr. Amit Shelat

Dr. Amit M. Shelat, DO, FACP, FAAN is the Honorary and Advisory Neurologist, and a Fellow of the United Sigma Intelligence Association. Dr. Shelat is a Professional Neurologist, and Assistant Professor of Clinical Neurology at Stony Brook University School of Medicine. He is the Vice Chairman of the New York State Board for Medicine. Dr. Shelat is also appointed to the Board for Professional Medical Conduct of the New York State Department of Health. Dr. Shelat is certified in neurology by the American Board of Psychiatry and Neurology and the American Osteopathic Board of Neurology and Psychiatry. Dr. Shelat is a Fellow of the American Academy of Neurology (FAAN), the American College of Physicians (FACP), the New York Academy of Medicine (FNYAM), the Federation of State Medical Boards (FFSMB) and the American Association of Osteopathic Examiners (FAAOE). Dr. Shelat completed his neurology residency in the Albert Einstein College of Medicine Program at Northwell Health. He completed his medical doctorate at the New York Institute of Technology College of Osteopathic Medicine. Dr. Shelat holds the Master of Science degree in Healthcare Management (MHCM) from the Harvard University, Harvard School of Public Health, and the Master of Public Administration (MPA) degree in Health Policy and Management from the New York University (NYU), Wagner Graduate School of Public Service. He completed his undergraduate studies at New York University (NYU) and graduated cum laude, Phi Beta Kappa with Bachelor of Arts in chemistry and psychology with departmental honors.

USIA Fellow, Dr. Brian Schwartz

Dr. Brian Schwartz, JD is the Advisory Board Member and a Fellow of the United Sigma Intelligence Association. Dr. Schwartz studied at University of Oxford and got a degree of Doctor of Law (JD) from Yale University Law School. He is an Executive Member of the Omega Society and the Prometheus Society, respectively.

Editorial by the Editor-in-Chief

Dear Reader(s),

Thank you for taking the time to read this inaugural issue of the *USIA Research Journal*, this amounts to the clerical letter:

The United Sigma Intelligence Association (USIA), formerly United Sigma Korea (USK), exists to gather exclusively gifted people with high levels of intelligence and/or education in order to provide an intellectual space to encourage the sharing and exploring of ideas while contributing to the fields of intelligence research, artificial and human. The USIA contains the first and the oldest 3 sigma, 4 sigma, and 5 sigma high intelligence societies in South Korea, founded by HanKyung Lee, MD on January 22, 2008, July 3, 2007, and July 25, 2012, respectively. With an international scope, the USIA is an umbrella association containing the Three Sigma Associate Society (TSA), the Four Sigma Associate Society (FSA), and the Extreme Sigma Associate Society (ESA), or 3 sigma, 4 sigma, and 5 sigma intelligence societies, respectively. The USIA is forming a network of respected real-world intellectuals based on high intelligence (estimated by a psychologist PhD or Psychiatrist MD) or equivalent educational/intellectual performance. It is integrating with world-class academics, outstanding scholars, and real-world intellectuals. It is encouraging high-level intellectuals through either top-level academic performance or real-world intellectual achievement. It is interviewing members and introduces members' works, and publishing as seen with the *USIA Research Journal*. Our current organizational structure exists as follows:

1) Founder
2) President/Executive Director
3) Executive Vice-President
4) Senior Vice-President
5) Senior Director/Editor-in-Chief
6) Senior Neuropsychologist/Senior Editor
7) Honorary/Advisory Board Members
8) ESA Fellows/Special Members
9) FSA Members/Special Members
10) TSA Members/Special Members.

Duly note, all USIA fellows remain in the ESA Fellow categorization, and vice versa, to avoid confusion. The *USIA Research Journal* results from communication, collaboration, and ongoing positive developments between Mr. Kim and I since 2019. It started from a message to me. Mr. Kim had an idea. He wanted to collaborate. Over time, this became working together on English-based letters and then reaching out to interested people, and, eventually, a working relationship as part of the USIA Executive Board as a Senior Director, a USIA Fellow, and the Editor-in-Chief of the *USIA Research Journal*. Things developed fast for us. I remain humbled and honored for this opportunity provided, fundamentally, by Dr. Lee and then Mr. Kim, as I exist, more or less, on the far periphery or orbit of the societies, the tests, and the larger community discussions here. The exchange between Mr. Kim and I will continue onwards, as seems typical by this time, in mutual learning, respect, and information exchange in the production of aspects of USIA and the production of the *USIA Research Journal*. Following these developments towards a non-peer-reviewed journal – important to note, and the inclusion of the Honorary/Advisory Board members, Mr. Kim decided to partner the USIA with the Mega Foundation and Mega International with the newest representation of the President and Executive Director of the Mega Foundation, respectively, on the Executive Board of the USIA in the middle of January, 2020. The Mega Foundation is a 501c(3) tax-exempt non-profit corporation established in 1999 to create and implement programs that aid in the development of severely gifted individuals and their ideas. USIA is the first organization devoted to high intelligence the Mega Foundation has made a partnership, since its inception in 1999. The formal partnership between USIA and the Mega Foundation and Mega International began in 2020. The submissions for the inaugural issue amount to Honorary/Advisory Board members or other fellows at this time. Some others include individuals with formal academic credentials and connections to post-secondary institutions while not operating as fellows or members of USIA, e.g., Yonsei University in South Korea as a professor.

I do not mean these as personal, associational, organizational, or societal critiques, or of those involved in the experimental and/or high range intelligence testing or communities, but as friendly, gentle, and transparent general points with varying validity on tests at these ranges – important for the general public too. As this amounts to an association (USIA), and the journal of an association (the *USIA Research Journal*), devoted to high ability representation and intellectual productions, on issues of intelligence testing, high range intelligence testing should be taken with honest skepticism grounded in the limited empirical development of the field at present, even in spite of honest and sincere efforts. If a higher general intelligence score, then the greater the variability in, and margin of error in, the general intelligence scores because of the greater rarity in the population. That is to say, human general intelligence amounts to an approximated human trait with greater variation in the findings with the rarer the ability one may hope to discover in a person or group of people within the human species. Whether TSA, FSA, or ESA, respectively, the same principles apply with greater variation as one moves from TSA to FSA to ESA levels of approximated general intelligence. The further principle of greater skepticism applies when one uses non-mainstream/alternative intelligence tests, especially non-mainstream/alternative intelligence tests above 4-sigma, in contrast to mainstream intelligence testing up to and including 4-sigma (e.g., TSA and FSA). The USIA only accepts mainstream intelligence tests and test scores for admissions, or, at a minimum, the most valid and substantiated general intelligence tests. Intelligence tests above 4-sigma, alternative/non-mainstream, have been compromised in the past, taken several times with only the higher scores claimed rather than the lower score or the average of the scores taken, taken in different circumstances under real names and pseudonyms, tend to exist with low sample sizes, may only test specific mental skills within the remit of general intelligence, may be unsupervised, may be mail-home, may be online, may mark a time of low confidence when testing, can be bound to the English language alone, may contain educational biases, may contain cultural biases, and may not correlate strongly, even sufficiently, with mainstream intelligence tests. The trust in them can exist, but should, probably, be moderated with several potential issues in different alternative tests. Even in mainstream intelligence tests, high heritability appears to exist in familial and twin studies for intelligence while comprehensive and robust genetic markers remain unseen or marginally observed at this time. Many facets of intelligence appear open questions with others as more closed questions than open now. Nonetheless, general intelligence does considerably correlate with educational achievement and success in some distinct variables of life.

Finally, I express appreciation and gratitude to the Founder of the USIA, formerly USK, Dr. HanKyung Lee, MD for founding USK in the 2000s and continuing into the 2010s, and the current President/Executive Director Mr. YoungHoon Kim for leadership of USIA in the latter portions of the 2010s and into the 2020s, the Executive Board including the Senior Editor and Executive Director of the Mega Foundation Dr. Gina Langan (and special thanks to Michal Szczęsny and the CTMU Media Workshop crew for proofreading Mr. Langan's submission alongside Dr. Langan's editorial work on metaphysics – full credit on Mr. Langan's materials to

Dr. Langan and them), Honorary/Advisory Board, and, most of all, the membership and the readership as none of this makes sense without you.

Through the creation of *USIA Research Journal*, the evolution of USK into USIA, and planned developments for USIA between Mr. Kim and I, we evolved something special, potentially unique. I hope this serves the community well and honors the trust given to us.

Your Stray Canadian,

Mr. Scott Douglas Jacobsen
Senior Director/Editor-in-Chief, USIA

Editorial by the Senior Editor

Dear USIA and Mega Foundation Members,

I am pleased to have the honor of introducing two important events, the launching of a partnership between USIA and the Mega Foundation and the publication of the premiere issue of the *USIA Research Journal*. For more than twenty years, the Mega Foundation has worked to change the landscape of the ultra-high IQ community and expand it from a network linking intelligent people with common interests to a magnet for exceptional minds which unites them in synergy for the betterment of mankind. We are now closer to that goal than ever.

We had the pleasure of meeting YoungHoon Kim last year when he joined us as a member of Mega International and accepted the position of Senior Membership Officer for the Ultranet and Mega International. Although we do not generally align ourselves with other high IQ groups as a matter of policy, the complementary nature of our organizations and ideals made it a logical decision. USIA has a polished and professional presentation, capable and dedicated personnel, and a roster of Fellows including some of the best minds on the planet.

Although I retired from clinical practice and teaching in recent years, I still maintain active involvement in research, consulting, and experimental investigation. Not having a current academic affiliation can isolate intellectuals who find themselves in a similar position. The high IQ community offers a unique opportunity for such people to share and collaborate in a broad multidisciplinary environment with accomplished intellectuals, pioneering autodidacts, and independent researchers from around the globe. The *USIA Research Journal* is an excellent example of how our voices can be channeled, broadcast, and heard the world over. Congratulations to YoungHoon Kim and Scott Jacobsen for bringing together so many luminaries to create the premiere issue of this important journal. A single article by any one of our contributors would be a capstone to the content of any other high IQ journal. To have all of these great thinkers appear to our premiere issue is truly a blessing and sign of great things to come.

Sincerely,

Dr. Gina L. Langan, PhD
Senior Neuropsychologist/Senior Editor, USIA
Executive Director, Mega Foundation

Editorial by the President

The *USIA Research Journal* is a research journal of the United Sigma Intelligence Association (USIA) in partnership with the Mega Foundation and Mega International. In the journal of the USIA, in this issue, the submissions have been included from leading intellectuals holding the fellowship of the USIA. It is honored for the roster of the USIA fellowship and the intellectual contributions to the journal with permissions granted for publication of the articles and the interviews.

The significance of *USIA Research Journal* is, presumably, the *consilience* of intellectuals with substantially high intelligence and academic excellence. For example, Professor Nick Bostrom of AI policies, Professor Peter Singer of applied ethics, and Christopher Langan in the area of very high human intelligence, and others. All of them have come to be exemplary in terms of consonance, or consilience mentioned before.

Secondly, another significance of the USIA may represent a shift in the very high intelligence organizations because none focused, in particular, on artificial intelligence (AI). Something of a *paradigm shift*. Some claim the future is bound to reach the age of maturity in AI technologies and algorithms. Subsequently, to be an essential organization of very high intelligence, it would be, in consequence, required that humanity must discern not only the traditional knowledge on the concept of general intelligence, but also the future-oriented acquaintance in the light of the exponential rate of the intelligence growth.

Lastly, the USIA has the opportunity to take the initiative of the inaugural journal and incorporate the fellowship of the USIA who are the founders or executive members of the Mega International, Mega Foundation, Mega Society, Omega Society, Olympiq Society, Prometheus Society, and Triple Nine Society, which are significantly higher than the level of the Mensa, on the one hand. Furthermore, some of the most influential living intellectuals such as Peter Singer, Nick Bostrom, Graham Priest, Aubrey de Grey, and Christopher Langan, on the other one.

Sincerely,

Mr. YoungHoon Kim (김영훈)

President/Managing Editor, USIA
Senior Membership Officer, Mega Foundation

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Strategic Implications of Openness in AI Development by Nick Bostrom

Prof. Nick Bostrom (University of Oxford)

Abstract: This paper attempts a preliminary analysis of the global desirability of different forms of openness in AI development (including openness about source code, science, data, safety techniques, capabilities, and goals). Short-term impacts of increased openness appear mostly socially beneficial in expectation. The strategic implications of medium and long-term impacts are complex. The evaluation of long-term impacts, in particular, may depend on whether the objective is to benefit the present generation or to promote a time-neutral aggregate of well-being of future generations. Some forms of openness are plausibly positive on both counts (openness about safety measures, openness about goals). Others (openness about source code, science, and possibly capability) could lead to a tightening of the competitive situation around the time of the introduction of advanced AI, increasing the probability that winning the AI race is incompatible with using any safety method that incurs a delay or limits performance. We identify several key factors that must be taken into account by any well-founded opinion on the matter.

I. Policy Implications

- *The global desirability of openness in AI development – sharing e.g. source code, algorithms, or scientific insights – depends – on complex tradeoffs.*
- *A central concern is that openness could exacerbate a racing dynamic: competitors trying to be the first to develop advanced (superintelligent) AI may accept higher levels of existential risk in order to accelerate progress.*
- *Openness may reduce the probability of AI benefits being monopolized by a small group, but other potential political consequences are more problematic.*
- *Partial openness that enables outsiders to contribute to an AI project's safety work and to supervise organizational plans and goals appears desirable.*

The goal of this paper is to conduct a preliminary analysis of the long-term strategic implications of openness in AI development. What effects would increased openness in AI development have, on the margin, on the long-term impacts of AI? Is the expected value for society of these effects positive or negative? Since it is typically impossible to provide definitive answers to this type of question, our ambition here is more modest: to introduce some relevant considerations and develop some thoughts on their weight and plausibility. Given recent interest in the topic of openness in AI and the absence (to our knowledge) of any academic work directly addressing this issue, even this modest ambition would offer scope for a worthwhile contribution.

Openness in AI development can refer to various things. For example, we could use this phrase to refer to open source code, open science, open data, or to openness about safety techniques, capabilities, and organizational goals, or to a non-proprietary development regime generally. We will have something to say about each of those different aspects of openness – they do not all have the same strategic implications. But unless we specify otherwise, we will use the shorthand 'openness' to refer to the practice of releasing into the public domain (continuously and as promptly as is practicable) all relevant source code and platforms and publishing freely about algorithms and scientific insights and ideas gained in the course of the research. Currently, most leading AI developers operate with a high but not maximal degree of openness. AI researchers at Google, Facebook, Microsoft and Baidu regularly present their latest work at technical conferences and post it on preprint servers. So do researchers in academia.

Sometimes, but not always, these publications are accompanied by a release of source code, which makes it easier for outside researchers to replicate the work and build on it. Each of the aforementioned companies have developed and released under open source licences source code for platforms that help researchers (and students and other interested folk) implement machine learning architectures. The movement of staff and interns is another important vector for the spread of ideas. The recently announced OpenAI initiative even has openness explicitly built into its brand identity.

Many other companies are more secretive or proprietary, particularly ones whose AI work is more application-oriented. Even the most open of the current large efforts is not maximally open. A higher degree of openness could be achieved, for instance, through always-on webcams and microphones in the lab, so that outsiders could eavesdrop on research conversations and management meetings or even actively participate as new ideas are being proposed and discussed. Or a lab could hire out employees as consultants to help other groups working on similar problems. Openness is thus not a binary variable, but a vector with multiple dimensions that each admits of degrees.

Although the main focus of this paper is on the long-term, we will set the stage by first discussing some short and medium-term implications. This will help us see how the long-term is different. It can also help us understand the behavior of actors who either do not care about the long-term or are instrumentally constrained by short and medium-term considerations.
The issue of the short and near-term desirability of openness can be roughly decomposed into two questions: (1) Does openness lead to faster AI development and deployment? (2) Is faster AI development and deployment desirable? Let us examine these in turn.
Does openness lead to faster AI development and deployment?

For the short-term, the case appears relatively straightforward. The main short-term effect of opening existing AI research (e.g. by open-sourcing code and placing related intellectual property into the public domain) would be to hasten the diffusion and application of current state-of-the-art techniques. Software and knowledge about algorithms are non-rival goods.

Making them freely available would enable more people to use them, at low marginal cost. The effect would be small, since so much is already in the public domain, but positive.
For the medium-term, the case is more complicated. If we conceive of the medium-term as a period that is long enough to allow for significant new research to take place and to be developed to the point of practical application, then we must take into account the dynamic effects of openness. In particular, we must consider the impact of openness on incentives to invest in R&D. We may also need to take into account other indirect effects, such as impacts on market structure (Casadesus-Masanell and Ghemawat, 2003).

Consider first the imposition of a general rule – it could be a change in intellectual property law, a regulatory requirement, or a cultural norm – that pushes AI developers towards greater openness. We might then expect the short-term benefits described above. But there is also tradition in economic thought, harkening back to Joseph Schumpeter (**1942**), which points to a tradeoff between static and dynamic efficiency. Basic ideas are public goods; and in the absence of (some degree of) monopoly positioning or market power, a firm is unable to appropriate the value of the new ideas it originates (Arrow, **1962**; Shell, **1966**, **1967**). From this perspective, monopoly rents, while they reduce static efficiency and welfare in the short run, provide incentives for innovation that can improve dynamic efficiency and welfare over a longer period. Consequently, a rule that makes it harder for a developer to earn monopoly rents from the ideas it generates (for instance a rule that discourages the use of trade secrecy or patents) could have a negative medium-term impact on the speed of AI development and deployment.

Not all economic incentives for innovation would disappear in an open non-proprietary innovation regime (See e.g. Boldrin and Levine, **2008**). One reason firms engage in open non-proprietary R&D is to build ‘absorptive capacity’: conducting original research as a means of building skill and keeping up with the state-of-the-art (Cohen and Levinthal, **1989**; Griffith et al., **2004**). Another reason is that copying and implementing an idea takes time and effort, so the originator of a new idea may enjoy a period of effective monopoly even if the idea is freely communicated and no legal barrier prevents others from adopting it. Even a brief period of exclusive possession of an idea can enable its originator to profit by trading on insider knowledge (e.g. by being first to know that a new market-impacting technology has now become feasible) (Hirshleifer, **1971**). Another incentive for innovation in the open non-proprietary regime is that the originator of an idea may profit from owning a complementary asset whose value is increased by the new idea.[1] For example, a mining company that develops a new technique to exploit some of its previously inaccessible ore deposits may derive some profit from its invention even if other mining companies are free to copy the technique (though typically less than if its competitors had to pay license fees). Similarly, a software firm might choose to give away its software gratis in order to increase demand for consulting services and technical support (which the firm, having written the software, is in a strong position to supply).

Furthermore, in the open source software sector, significant contributions are made by individuals who are volunteering their own free time. One motive for such contributions is that they enable a programmer to demonstrate skill, which may raise his or her market value (Hann et al., **2004**).[2] Such a skill-signaling motive appears to be a strong influence among many AI researchers. Researchers prefer to work for organizations that allow them to publish and present their work at technical conferences, partly because doing so helps the researcher build a reputation among peers and potential employers. The skill-signaling motive is probably especially strong among the most capable young researchers, since they have the most to gain from being able to show off their abilities. This gives organizations seeking to hire the most talented AI researchers a reason to opt for openness – openness in the sense of refraining from trade secrecy, though not necessarily from patenting[3] – a reason that is quite independent of any altruistic concern with promoting scientific progress or general welfare.

So some incentives for innovation would remain in a regime of openness (even aside from public subsidy or philanthropy). Nevertheless, it is possible that R&D investment would fall if all incentives from monopoly exploitation were removed from the mix. Such a reduction in R&D expenditure would have to be balanced against other effects of openness that may tend to boost technical progress. For example, the patent system involves substantial transaction costs which would be eliminated in a fully open development regime – innovators would then not have to hack their way through 'patent thickets' to get a new product to market. And the relinquishment of trade secrecy and confidentiality would facilitate information flow between researchers who work for different organizations, reducing duplication of effort and other inefficiencies.

In view of these countervailing considerations, it may not be possible to give a general answer to the question of whether a rule pushing towards greater openness would help or hinder technical progress. The sign of the effect would depend on context and the particular form of openness being contemplated (Lerner and Tirole, **2005**). We should note that even if there were a slight negative effect on the rate of progress from greater openness, the welfare implications could still be positive (for the short and even the medium term). This is because openness would improve static efficiency, by making products available at marginal cost (e.g. in the form of open source software) and allowing a given level of state-of-the-art technical capability to diffuse more quickly through the economy. If, however, there were a large negative effect on the rate of progress, then the welfare losses from that effect would plausibly dwarf the welfare gains from increased static efficiency, especially over longer time scales.

So far we've been considering the effects of the establishment of a general rule promoting greater openness. We could instead inquire about the effects of a unilateral decision by one actor to pursue greater openness – for example an AI lab that, perhaps for altruistic reasons, opts for a higher level of openness than would be commercially optimal. (We will assume that the money lost by deviating from the commercially optimal policy would otherwise have been spent on consumption of a form that would not affect the rate of technological advance.) Would such a unilateral decision speed technical progress?

In this case we can set aside the incentive effects that could reduce R&D spending if the increase in openness were the result from an exogenous shift in cultural norms or intellectual property rights. The benefits of openness discussed earlier would still accrue. So this case is more favorable to the hypothesis that openness speeds progress. It may be noted that academia, which is less dependent than the commercial sector on monopoly rents, has a relatively strong culture of openness,**4** what the sociologist Robert Merton called the 'communist norm',**5** and there is currently a push to make it yet more open (Nosek, **2015**). Even so, it is possible to construct models in which even a unilateral altruistically-motivated decision by a developer to pursue a course of open development reduces total R&D spending. For instance, Saint-Paul (**2003**) presents an endogenous growth model in which, for some parameter values, such a philanthropic intervention reduces growth rates and welfare by crowding out a disproportionate amount of proprietary innovation.**6** So the picture is not clear. On balance, it might still be plausible that a philanthropically motivated R&D funder would speed progress more by pursuing open science, at least if we assume that the research is focused on theoretical matters or process innovations (as opposed to the development of a particular product that directly competes with commercial alternatives).**7**

II. Is faster technological progress and rollout of AI capabilities desirable?

This brings us to the second question about the short and near-term desirability of openness: supposing openness would speed technical progress and rollout of AI capabilities, would that be socially beneficial?

It is clear that machine intelligence holds great promise for positive applications across many sectors of the economy and society, including transportation, healthcare, the environment, entertainment, security, and scientific discovery. For instance, an estimated 1.2 million people die every year in road accidents around the world, a number that could eventually be reduced to a low level as AI-enabled vehicles take over more functions from human drivers (Goldman Sachs, **2015**). A report by McKinsey estimates an economic impact of several trillions of dollars annually from AI-related technologies by 2025.**8** A full review of the potential positive applications is outside the scope of this paper.

As with any general-purpose technology, it is possible to identify concerns around particular applications. It has been argued, for example, that military applications of AI, including lethal autonomous weapons, might incite new arms races, or lower the threshold for nations to go to war, or give terrorists and assassins new tools for violence (Future of Life Institute, **2015**). AI techniques could also be used to launch cyber attacks. Facial recognition, sentiment analysis, and data mining algorithms could be used to discriminate against disfavored groups, or invade people's privacy, or enable oppressive regimes to more effectively target political dissidents (Balkin, **2008**). Increased reliance on complex autonomous systems for many essential economic and infrastructural functions may create novel kinds of systemic accident risk or present vulnerabilities that could be exploited by hackers or cyber-warriors (See Perrow, **1984**). Insofar as it is possible to fine-tune openness choices so as to differentially expedite specific kinds of AI applications, these concerns might indicate the need for making exceptions to a generally pro-openness stance. For example, open-sourcing the code for autonomous weapons seems undesirable, and we have not heard anybody calling for that to be done. But basic research in AI is typically not application-specific in this way. Rather, to the extent that it succeeds, it will deliver algorithms and techniques that could be used in a very wide range of applications. This holds, in particular, for most work in current focal areas such as deep learning and reinforcement learning: that work is exciting precisely because it seeks general solutions to learning problems that occur in a wide range of tasks and environments.

Another frequently expressed area of concern is that advances in AI will create labor market dislocations and reduce the employability of some workers (Autor, **2015**; Brynjolfsson and McAfee, **2014**). It is not clear that near and medium-term AI capabilities pose any distinctive challenges in this regard, challenges that do not apply to automation generally and indeed to a large portion of all technological change, which often reduces demand for some types of human labor. Concerns about technological unemployment are not new. After the Industrial Revolution, developed countries underwent a shift from overwhelmingly agricultural to industrial and, later, service-oriented economies. The initial phase of industrialization imposed great burdens on significant portions of the population.**9** Over time, however, subsequent to the introduction of new social policies and a prolonged period of historically unprecedented rates of economic growth, industrialization has resulted in large gains for human prosperity, gains reflected in indices on nutrition, health, life expectancy, access to information, mobility, and other measures of human welfare (Galor and Moav, **2004**; United Nations Development Programme and Malik, **2014**). If, as a first-order approximation, we model the impacts of near and medium-term AI advances as a continuation and extension of longstanding trends of automation and productivity-increasing technological change, therefore, we would estimate that any adverse labor market impacts would be greatly outweighed by economic gains. To think otherwise would seem to entail adopting the generally luddite position that perhaps a majority of current technological developments have a net negative impact.

We can make a similar point with regard to the concern that advances in AI might exacerbate economic inequality. This, too, is best thought of in a more general context, as part of a wider discussion about technological change and inequality. Most contemporary debate around these matters takes for granted that technological progress is broadly desirable: mainstream controversy being limited to how governments and societies ought to adapt in order to accelerate development and diffuse the benefits more widely while managing any particular challenges that might flow from some aspect of the new technology. It is worth noting here that openness in AI, aside from whatever effect it might have on speed of development and general economic growth, could also have some distinctive impacts on inequality. Most obviously, releasing software in the public domain makes it available free of charge, which could have some equalizing effect on the levels of welfare attainable by people at different segments of the income distribution (provided they have the requisite hardware and skill to use it, and that it is relevant to their needs). Open source software may also differentially benefit technically sophisticated users, compared to commercial software (Bessen, **2006**; Lerner and Tirole, **2005**; Schmidt and Schnitzer, **2003**).

III. Summary of near and medium-term impacts

Much current work in AI is to a large extent open. The effect of various kinds of unilateral marginal increases in openness on the rate of technical advance in AI is somewhat unclear but plausibly positive, especially if focused on theoretical work or process innovation. The effect of marginal increases in openness brought about through exogenous pressure, such as shifts in cultural norms or regulation, is ambiguous as far as we have been able to explore the matter in the present analysis.

The short and medium-term impacts of accelerating advances in AI appear to be substantially positive in expectation, primarily because of diffuse economic benefits across many sectors. A number of specific areas of concern can be identified, including military uses, applications for social control, and systemic risks from increased reliance on complex autonomous processes. However, for each of these areas of concern, one could also envisage prospects of favorable impacts, which seem perhaps at least equally plausible. For example, automated weaponry might reduce human collateral damage or change geopolitical factors in some positive way; improved surveillance might suppress crime, terrorism, and social free-riding; and more sophisticated ways of analyzing and responding to data might help identify and reduce various kinds of systemic risk. So while these areas of concern should be flagged for ongoing monitoring by policy makers, they do not at our current state of knowledge change the assessment that faster AI progress would likely have net positive impacts in the short and medium-term. A similar assessment can be made regarding the concern that advances in AI may have adverse impacts on labor markets or economic inequality: some favorable impacts in these areas are also plausible, and even if they were dominated by adverse impacts, any net adverse impact in these areas would most likely be outweighed by the robustly positive impact of faster economic growth. We also noted the possibility that openness, particularly in the form of placing technology and software in the public domain, may have some positive impact on distributional concerns by lowering the economic cost for users to access AI-enabled products (though if open source software displaces some amount of proprietary software, and open source software is more adapted to the needs of technically sophisticated users, then it is not entirely clear that the distributional impact would favor those segments of the population that are both low-income and low-skill).

In a nutshell: unilateral decisions by AI developers to be incrementally more open about their basic research and process innovations would probably have some net positive near and medium-term social impacts and would on the margin accelerate AI progress. In other respects, however, the medium-term strategic ramifications of different forms of openness are more ambiguous and uncertain than might have been suspected.

We will assess the long-term desirability of openness in AI development with reference to how openness affects the following two paramount problems tied to the creation of extremely advanced (generally human-level or superintelligent) AI systems (See Bostrom, **2014a**):

- *The control problem: how to design AI systems such that they do what their designers intend.*
- *The political problem: how to achieve a situation in which individuals or institutions empowered by such AI use it in ways that promote the common good.*

The impact of openness on both the control problem and the political problem must be analyzed. Here we identify three main pathways by which openness in AI development may have such impact or otherwise intersect with long-term strategic considerations: (1) openness may speed AI development; (2) openness may make the race to develop AI more closely competitive; (3) openness may promote wider engagement.

IV. Openness may speed AI development

We argued in the previous section that faster AI progress is a plausible consequence of at least some forms of openness. This could have strategically relevant impacts in several ways, as follows.

V. Making the benefits of AI accrue sooner

This is important if currently existing people have a strongly privileged status over future generations in one's decision criteria. Since the human population is dying off at a rate of almost 1% per year, even modest effects on the arrival date of superintelligence could have important decision-relevance for such a 'person-affecting' objective function (assuming superintelligence would, with substantial probability, dramatically reduce the death rate or improve wellbeing levels) (Bostrom, **2003**). Earlier onset of benefits would also be important if one uses a significant time discount factor. (However, making the benefits start earlier is not clearly significant on an impersonal time-neutral view, where instead it looks like the focus should be on reducing existential risk (Bostrom, **2013**).)

VI. Less time to prepare

Expedited AI development would give the world less time to prepare for advanced AI. This may reduce the likelihood that the control problem will be solved. One reason is that safety work is likely to be relatively open in any case, and so would not gain as much as non-safety AI work from additional increments of openness in AI research generally. Safety work may thus be decelerated compared to non-safety work, making it less likely that a sufficient amount of safety work will have been completed by the time advanced AI becomes possible.**10** There are also some processes other than direct work on AI safety that may improve preparedness over time – and which would be given less time to play out if AI happens sooner – such as cognitive enhancement and improvements in various methodologies, institutions, and coordination mechanisms (Bostrom, **2014a**).**11** (The impact on the political problem of earlier AI development is harder to gauge, since it depends on difficult-to-predict changes in the broader social and geopolitical landscape over the coming decades.)

VII. Preempt other existential risks

Accelerated AI would increase the chance that superintelligent AI will preempt existential risks stemming from non-AI sources, such as risks that may arise from synthetic biology, nuclear war, molecular nanotechnology, or other risks as-yet unforeseen. This preempting effect depends on the arrival of superintelligent AI actually eliminating or reducing other major anthropogenic existential risks.**12** (Whether it does so may depend partly on whether the post-AI-transition world is multipolar or unipolar, a topic to which we shall return to below.)

In summary, the fact that openness may speed up AI development seems positive for goals that strongly prioritize currently existing people over potential future generations, and uncertain for impersonal time-neutral goals. Either of these effects appear relatively weak compared to other strategy-relevant impacts from openness in AI development, because we would not expect marginal increases in openness to have more than a modest influence on the speed of AI development.

VIII. Openness making AI development race more closely competitive

One weighty consideration is that the final stages of the race to create the first superintelligent AI are likely to be more closely competitive in open development scenarios. The reason for this is that openness would equalize some of the variables that otherwise would cause dispersion in the levels of capability or progress-rates among different AI developers. If everybody has access to the same algorithms, or even the same source code, then the principal remaining factors that could produce performance differences are unequal access to computation and data. One would therefore expect there to be a larger number of actors with the ability to wield near state-of-the-art AI in open development scenarios (Armstrong et al., **2016**). This tightening of the competitive situation could have the following important effects on the control problem and the political problem.

IX. Removes the option of pausing

In a tight competitive situation, it could be impossible for a leading AI developer to slow down or pause without abandoning its lead to a competitor. This is particularly problematic if it turns out that an adequate solution to the control problem depends on the specifics of the AI system to which it is to be applied. If there is some necessary part of the control mechanism that can only be invented or installed after the rest of the AI system is highly developed, then it may be crucial that the developer has the ability to pause progress on making the system smarter until the control work can be completed. Suppose, for example, that designing, implementing, and testing a control solution requires six months of additional work after the rest of the AI is fully functional. Then, in a tight competitive situation, any team that chooses to undertake that control work might simply abandon the lead – and with it, possibly, the ability to influence future events – to some other less careful developer. If the pool of potential competitors with near state-of-the-art capabilities is large enough, then one would expect it to contain at least one team that would be willing to proceed with the development of superintelligent AI even without adequate safeguards. The larger the pool of competitors, the harder it would be for them to all coordinate to avoid a risk race to the bottom.

X. Removes the option of performance-handicapping safety

Another way in which a tight competitive situation is problematic is if the mechanisms needed to make an AI safe reduces the AI's effectiveness. For example, if a safe AI runs a hundred times slower than an unsafe AI, or if safety requires an AI's capabilities to be curtailed, then the implementation of safety mechanisms would handicap performance. In a close competitive situation, unilaterally accepting such a handicap could mean forfeiting the lead. By contrast, in a less competitive situation (such as one in which a large coalition has a sizeable lead in technology or computing power) there might be enough slack that the frontrunner could implement some efficiency-reducing safety measures without abandoning its lead. The sacrifice of performance for safety may need to be only temporary, a stopgap until more sophisticated control methods are developed that eliminate the efficiency-disadvantage of safe AI. Even if there were inescapable tradeoffs between efficiency and safety (or ethical constraints preventing certain kinds of instrumentally useful computation), the situation would still be salvageable if the frontrunner has enough of a lead to be able to get by with less than maximally efficient AI for a period of time: since during that time, it might be possible for the frontrunner to achieve a sufficient degree of global coordination (for instance, by forming a 'singleton', discussed more below) to permanently prevent the launch of more efficient but less desirable forms of AI (or prevent such AI, if launched, from outcompeting more desirable forms of AI) (Bostrom, **2006**).

XI. Lowers probability of a small group capturing the future

There are some other consequences of tighter competition in the runup to superintelligent AI that are of more uncertain valence and magnitude, but potentially significant. One such consequence is for the political problem. A tighter competitive situation would make it less likely that one AI developer becomes sufficiently powerful to monopolize the benefits of advanced AI. This is one of the stated motivations for the OpenAI project, expressed for example, by Elon Musk, one its founders:

> *I think the best defense against the misuse of AI is to empower as many people as possible to have AI. If everyone has AI powers, then there's not any one person or a small set of individuals who can have AI superpower.* (Levy, **2015**)

Openness may thus make it more likely that many people's preferences influence the future. Depending on one's values and expectations (e.g. one's expectations about which preferences would rule if the future were instead captured by a small group), this could be an important consideration.

XII. Affect influence of status quo powers?

Another consequence for the political problem: openness in AI development may also influence what kind of actor is most likely to achieve monopolization (if such there be) or to achieve a relatively larger influence over the outcome. Access to computing power (and possibly data) becomes relatively more important if access to algorithms or source code is equalized. In expectation, this would align influence over the post-AI world more closely with wealth and power in the pre-AI world, since computing power is fairly widely distributed (including internationally), quite fungible with wealth, and somewhat possible for governments to control – in comparison with access to algorithmic breakthroughs in a closed development scenario, which might be more lumpy, stochastic, and local. The likelihood that a single corporation or a small group of individuals could make a critical algorithmic breakthrough needed to make AI dramatically more general and efficient seems greater than the likelihood that a single corporation or a small group of individuals would obtain a similarly large advantage by controlling the lion's share of the world's computing power.**13** Thus, if one thinks that it is preferable in expectation that advanced AI be controlled by existing governments, elites, and ordinary people – in proportion to their existing wealth and political power – rather than by some particular group that happens to be successful in the AI field (such as a corporation or an AI lab) then one might favor a scenario in which hardware becomes the principal factor of AI power. Openness in AI development would make such a scenario more likely.

However, openness would also reduce the economies of scale in AI research labs, and this would favor smaller players who may be less representative of status quo power. Consider the opposite case: development is perfectly closed, and any wannabe AI developer must make all the relevant discoveries and build all the needed components in-house. Unless the successful AI architecture turns out to be extremely simple, this regime would strongly favor larger development groups – the odds of a given group winning the race would scale superlinearly with group size. By contrast, if development is open and the winning group is the one that adds a single final insight to a shared corpus of ideas, then the probability of a given group being the winner might instead scale roughly linearly with size.**14** So in scenarios where there is a hardware overhang, and an intelligence explosion is triggered by a final algorithmic invention, openness would increase the probability of a small group capturing the future.

Consequently, if larger development groups (such as large corporations or national projects) are typically more representative of, or controlled by, status quo powers than a randomly selected small development group (such as a 'guy in a garage') then openness may either increase or decrease the degree of influence status quo powers would have over the outcome, depending on whether hardware or software is the bottleneck. Since it is currently unclear what the bottleneck will be, the impact of openness on the expected degree of control of status quo powers is ambiguous.

XIII. Reduces probability of a singleton

A singleton is a world order in which there is at the highest level of organization one coordinated decision-making agency. In other words, a singleton is a regime in which major global coordination or bargaining problems are solved. The emergence of a singleton is thus consistent with both scenarios in which many human wills together shape the future and scenarios in which the future is captured by narrow interests. The point that openness in AI development seems to lower the probability of a singleton is therefore distinct from the point made that openness seems to lower the probability of a small group capturing the future. One could be against a small group capturing the future and yet for the formation of a singleton. There are a number of serious problems that can arise in a multipolar outcome that would be avoided in a singleton outcome.

One such problem is that it could turn out that at some level of technological development (and perhaps at technological maturity) offence has an advantage over defense. For example, suppose that as biotechnology matures, it becomes inexpensive to engineer a microorganism that can wreak havoc on the natural environment while it remains prohibitively costly to protect against the release and proliferation of such an organism. Then, in a multipolar world, where there are many independent centres of initiative, one would expect the organism eventually to be released (perhaps by accident, perhaps as part of a blackmail operation, perhaps by an agent with apocalyptic values, or maybe in warfare). The chance of avoiding such an outcome would seem to decrease with the number of independent actors that have access to the relevant biotechnology. This example can be generalized: even if in biotechnology offence will not have such an advantage, perhaps it will in cyberwarfare? in molecular nanotechnology? in advanced drone weaponry? or in some other as-yet unanticipated technology that would be developed by superintelligent AIs? A world in which global coordination problems remain unsolved even as the power of technology increases towards its physical limits is a world that is hostage to the possibility that – at some level of technological development – nature too strongly favors destruction over creation. From the perspective of existential risk reduction, it may therefore be preferable that some institutional arrangement emerges that enables robust global coordination. This may be more tractable if there are fewer actors initially in possession of advanced AI capabilities and needing to coordinate.

The possibility that offence might have an inherent advantage over defense is not the only concern with a multipolar outcome. Another concern is that in the absence of global coordination it may be impossible to forestall a population explosion of digital minds and a resulting Malthusian era in which the welfare of those digital minds may suffer (Bostrom, **2004**, **2014a**; Hanson, **1994**). Independent actors would have strong incentives to multiply the number of digital workers under their control to the point where the marginal cost of producing another one (including electricity and hardware rental) equals the revenue it can bring in by working maximally hard. Local or national legislation aimed at protecting the welfare of digital minds could shift production to jurisdictions that offer more favorable conditions to investors. This process could unfold rapidly since software faces fewer barriers to migration than biological labor, and the information services it provides are largely independent of geography (though subject to latency effects from long-distance signal transmission, which could be significant for digital minds operating at high speeds). The long-run equilibrium of such a process is difficult to predict, and might be primarily determined by choices made after the development of advanced AI; but creating a state of affairs in which the world is too fractured and multipolar to be able to influence where it leads should be a cause for concern, unless one is confident (and it is hard to see what could warrant such confidence) that the programs with the highest fitness in a mature algorithmic hyper-economy are essentially coextensive with the programs that have the highest level of subjective well-being or moral value.

XIV. Relevance of AI multiplicity for control problem

It might be thought that tighter competition would promote a more desirable outcome by helping solve the control problem. The idea would be that in a more closely competitive scenario, it is less likely that a single AI system gets so far ahead of all the others as to obtain a decisive strategic advantage. Instead, there would more likely be a multiplicity of AI systems, built by different people in different countries for different purposes, but with comparable levels of capability. In such a multipolar world, it might be harder for any one of those AI systems to cause extreme damage – even if the controls applied to it were to fail – because there would be other AIs, presumably under human control, to hem it in.

This line of thinking is quite problematic as an argument for openness, even if we set aside the general concerns with multipolarity set out above. The existence of multiple AIs does not guarantee that they will act in the interests of humans or remain under human control. (Analogy: the existence of many competing modern human individuals did little to promote the long-term prospering of the other hominid species with which Homo sapiens once shared the planet.) If the AIs are copies of the same template, or slight modifications thereof, they might all contain the same control flaw. Open development may in fact increase the probability of such homogeneity, by making it easier for different labs to use the same code base and algorithms instead of inventing their own.

There is also the possibility of systemic failures resulting from unexpected interactions of different AIs. We know that such failures can occur even with very simple algorithms (witness, e.g., the Flash Crash; US Securities Exchange Commission, **2010**). Among advanced artificial agents that are capable of highly sophisticated planning and strategic reasoning (and which might be able to coordinate using different or more effective means than humans (See e.g. LaVictoire et al., **2014**)), there may be additional and novel ways for systemic failures to occur. Even if some balance-of-power equilibrium prevented any individual AI or coalition of AIs from infracting human interests, it is not clear we could be confident that it would last.**15**

If it really were helpful for control to have a multiplicity of AIs, it might be better that the AIs be created by a single actor, who would have a greater ability to ensure that the AIs are balanced in capability. Granted, AIs created by a single developer may be more similar to one another, and hence more prone to correlated control failures, than AIs created by different developers. Yet openness, we noted, though it may increase the likelihood that there will be multiple simultaneous developers, would also tend to make the AIs created by those developers be based on more similar designs. So the net effect of openness on the probability that there will be a diverse set of AIs is ambiguous.

We could put together a set of assumptions that would support the proposition that we should aim to obtain a solution to the control problem through the creation of a multiplicity of AIs by means of adopting a policy of openness. For example, we could stipulate that multiplicity of AIs, even if they are based on the same design, would contribute to safety provided only that the AIs be given different goals. The argument would then be that AIs created by different developers would naturally be given different goals, and would thus contribute to the public good of safety; whereas a single developer would either only create a single AI or create multiple AIs with identical goals (because giving an AI a goal different from your own would incur a private cost to you, since that AI will then not be working purely in your interest). The vision here might be a world containing many AIs, each pursuing a different goal, none of them strong enough to seize control unilaterally or by forming a coalition with other AI powers. These AIs would compete for customers and investors by offering us favorable deals, much like corporations competing for human favors in a capitalist economy.

The role of the state in this model needs to be considered. Without a state powerful enough to regulate the competing AIs and enforce law and order, it may be questionable how long the balance-of-power equilibrium would last and how humans would fare under it. An alternative – less attractive – analogue might be 17th century Europe, where the AIs would correspond to stronger states and the human populations would correspond to little principalities that hope to achieve security by aligning themselves with a strong (winning) AI coalition.

In summary, openness would be expected to make the AI development race more closely competitive, and this would have several strategic consequences. It would make it harder to pause towards the end in order to implement or test a safety mechanism. It would also make it harder to use any safety mechanism that reduces efficiency. Both of these look like important negative effects on the control problem. Openness also has consequences for the political problem: decreasing the probability that a small group will monopolize the benefits of advanced AI and decreasing the probability of a singleton. It may either increase or reduce the influence of status quo powers over the post-AI future depending on whether the transition is mainly hardware or software constrained. Furthermore, there may be impacts on the control problem via the distribution of AIs that result from open development, though the magnitude and sign of those impacts are unclear: openness may make a multiplicity of AIs more likely, which could increase the probability of some kind of balance-of-power arrangement between AIs; yet openness could also make the AIs more similar to one another than they would have been if the multiplicity of AI scenario had come to pass without openness and thus more likely to exhibit correlated failures. (In any case, it is unclear whether a multiplicity of diverse AIs created by different developers would really help with the control problem.)

XV. Openness promoting wider engagement

One class of potentially strategically significant effects of openness in AI development is that openness might increase external engagement with various aspects of state-of-the-art AI technology. That openness should increase external interest and attention is not axiomatic. Sometimes an attempt to keep something secret only serves to draw more attention to it. However, in cases where meaningful engagement requires detailed information and fine-grained access, it is plausible that increased openness would increase such engagement.

XVI. External perspectives illuminate safety

Somebody might thus argue that if AI systems are kept secret, then outside experts cannot directly work on making them safer, and that this would make a closed development scenario riskier. Note, however, that if AI systems are kept secret, then outside experts also cannot directly work on making them more effective. So, at a first glance, it may look like a tie: and if there is no differential effect on safety here, then we are back to the point that openness might just generally speed things up, both safety and effectiveness research, which we discussed in an earlier section. But one might speculate that work on safety would gain more from outside participation than work aimed at increasing AI effectiveness – perhaps on grounds that safety engineering and risk analysis are more vulnerable to groupthink and other biases, and would therefore benefit disproportionately from having external perspectives brought to bear. It is presumably easier to delude oneself about the safety of the AI one is building than to delude oneself about its capabilities, since there are more opportunities for objective feedback about the latter. Therefore, if there is an optimism bias, it would have freer rein to distort beliefs about safety than about efficacy. And if outside perspectives are a corrective to such a bias, their inclusion would thus differentially promote progress on safety.[16]

XVII. Outside participants more altruistic?

Furthermore, one could argue that because safety is a public good, external researchers (and their funders) are comparatively more likely to help work on safety than on effectiveness (relative to the allocation of effort that a particular developer would make internally, since the insiders probably have relatively stronger non-altruistic motives for working on effectiveness). Openness in AI development could then, by enabling disinterested outsiders to contribute, increase the overall fraction of AI-related effort that is focused on safety and thereby improve chances that the control problem finds a timely solution.

For a group that is sufficiently exceptionally altruistic and safety-oriented, this argument might go into reverse. For such a group, openness could dilute the focus on public goods by enabling participation by less-conscientious outsiders.[17,18]

XVIII. Influence on architecture?

It is possible that organizational mechanics of an open development trajectory might affect the character of the AI that is created, for better or worse. The ‘coral reef’ approach common in open source software projects, for example, might result in a greedy pursuit of local optima rather than a patient search and design for global optima (Boudreau and Lakhani, **2015**). Or it might be the case that looser coupling among development groups encourages more functional modularity (compared to centralized processes, which might foster more tightly integrated unitary architectures). It's plausible that such effects might have significant implications for the control problem, but uncertainties about what those effects might be (as well as about whether some given effect would be positive or negative for the control problem) may be too large for these types of consideration to have much impact on our present deliberations.

XIX. Gives actors more foresight

Openness about capabilities – what machine intelligence is capable of at a given time and the expected timeline for further advances – would increase the ability of outsiders to influence or adapt to AI developments. This might increase the probability of nationalization of leading AI efforts, since it would make it easier for a government to see exactly when and where it would need to intervene in order to maintain control over advanced AI capabilities. Openness about the science and source code, by contrast, may decrease the probability of nationalization, by making AI development more widely distributed (including internationally) and thus harder for a government to scoop up. (Openness might also reduce the probability of nationalization by fostering a culture among AI researchers that is more inimical to governmental or corporate control of AI.)

Openness about capabilities, aside from facilitating government control of a pivotal AI breakthrough, would also help societies generally prepare, by providing various actors with a clearer view of the future. It is not immediately clear what effect this would have on the control problem or the political problem. Giving people more foresight into a major upcoming technological revolution may be expected to have diffuse positive effects by enabling planning and adaptation. In particular, openness could enable more accurate forecasting of risks related to the control problem, leading to more investment in solutions in states of the world where they are particularly needed.**19**

XX. Committing to sharing

We have already discussed how openness would tend to make the AI race more competitive, and how it might speed progress, as well as the short-term benefits to allowing the use of existing ideas and information at marginal cost. Here we note a further strategically relevant possible consequence: openness in the near-term could create some kind of lock-in that increases the chance that more advanced AI capabilities will similarly be made freely available (or that at least some components of advanced AI will be free, even if others – for example, computing power – remain proprietary). Such lock-in might occur if a cultural norm of openness takes root, or if particular AI developers make commitments to openness that they cannot later easily back out of. This would feed back into the issues mentioned before, giving present openness the tendency to make the AI race more competitive and perhaps faster also in the longer run.

But there is also a separate – beneficial – effect of openness lock-in, which is that it may foster goodwill and collaboration. The more that different potential AI developers (and their backers) feel that they would fully share in the benefits of AI even if they lose the race to develop AI first, the less motive they have for prioritizing speed over safety, and the easier it should be for them to cooperate with other parties to pursue a safe and peaceful course of development of advanced AI designed to serve the common good. Such a cooperative approach would likely have a favorable impact on both the control problem and the political problem.

In summary, an open development scenario could reduce groupthink and other biases within an AI project by enabling outsiders to engage more, which may differentially benefit risk analysis and safety engineering, thereby helping with the control problem. Outsider contributions might also be comparatively more altruistically motivated and hence directed more at safety than at performance. The mechanics of open collaboration may influence architectural choices in the development of machine intelligence, perhaps favoring more incremental 'coral reef' style approaches or encouraging increased modularity, though it is currently unclear how this would affect the control problem. Openness about capabilities would give various actors more insight into ongoing and expected development, facilitating planning and adaptation. Such openness may also facilitate governmental expropriation, whereas openness about science and code would counteract expropriation by leaving less proprietary material to be grabbed. Finally, if current openness choices are subject to lock-in effects, they would have direct effects on future levels of openness, and might serve as ways of committing to sharing the spoils of advanced AI (which would be helpful for both the control problem and the political problem).

XXI. Conclusions

We have seen that the strategic implications of openness in AI is a matter of considerable complexity.**20** Our analysis, and any conclusions we derive from it, remain tentative and preliminary. But we have at least identified several relevant considerations that must be taken into account by any well-grounded judgement on this topic.**21**

In addition to the consequences discussed in this paper, there are many local effects of openness that individual AI developers will want to take into account. A project might reap private benefits from openness, for example in recruitment (researchers like to publish and build reputations), by allowing managers to benchmark in-house research against external standards, and via showcasing achievements for prestige and glory. These effects are not covered in the present analysis since the focus here is on the global desirability of openness rather than the tactical advantages or disadvantages it might entail for particular AI groups.

XXII. General assessment

In the near term, one would expect openness to expedite dissemination of existing technologies, which would have some generally positive economic effect as well as a host of more specific effects, positive and negative, arising from particular applications – in expectation, net positive. From a near-term perspective, then, pretty much any form of increased openness is desirable. Some areas of application raise particular concerns (including military uses, applications for social control, and systemic risks from increased reliance on complex autonomous processes) and these should be debated by relevant stakeholders and monitored by policy makers as real-world experience with these technologies accumulates.

Impacts on labor markets may to a first approximation be subsumed under the more general category of automation and labor-saving technological progress, which has historically had a massive net positive impact on human welfare though not without heavy transition costs for segments of the population. Expanded social support for displaced workers and other vulnerable groups may be called for should the pace or extent of automation substantially increase. The distributional effects of increased openness are somewhat unclear. Historically, open source software has been embraced especially by technically sophisticated users

(Foushee, 2013); but less skilled users would also stand to benefit (e.g. from products built on top of open source software or by using sophisticated users as intermediaries).**22**

The medium-term effects of openness are complicated by the possibility that openness may affect incentives for innovation or market structure. The literature on innovation economics is relevant here but inconclusive. A best guess may be that unilateral increases in openness have a positive effect on the rate of technical advance in AI, especially if focused on theoretical work or process innovations. The effect of increases in openness produced by exogenous pressure (e.g. from regulation or cultural norms) is ambiguous. The medium-term impact of faster technical advance in AI may be assessed in a similar way to shorter-term impacts: there are both positive and negative applications, and lots of uncertainty; yet a reasonable guess is that medium-term impacts are net positive in expectation (an expectation that is based, largely, on extrapolation of past technological progress and economic growth). Potential medium-term impacts of concern include new forms of advanced robotic warfare – which could conceivably involve destabilizing developments such as challenges to nuclear deterrence (e.g. from autonomous submarine-tracking bots or deep infiltration of enemy territory by small robotic systems; Robb, 2016) – and the use of AI and robotics to suppress riots, protests, or opposition movements, with possibly undesirable ramifications for political dynamics (Robb, 2011).

Our main focus has been on the long-term consequences of openness. If we consider long-term consequences, but our evaluation function strongly privileges impacts on currently existing people, then an especially important consideration is whatever tendency open development has to accelerate AI progress: both because faster AI progress would mean faster rollout of near and medium-term economic benefits from AI but even more because faster AI progress would increase the probability that some currently existing people will live long enough to reap the far greater benefits that could flow from machine superintelligence (such as superlongevity and extreme prosperity). If, instead, our evaluation function does not privilege currently existing people over potential future generations, then an especially important consideration is the impact of openness on cumulative amount of existential risk on the trajectory ahead (Bostrom, 2003, 2013).

In this context, then, where the focus is on long-term impacts, and especially impacts on cumulative existential risk, we provided an analysis with respect to two critical challenges: the control problem and the political problem. We identified three categories of potential effect of openness on these problems. We argued the first one of these – that openness may speed AI development – appears to have relatively weak strategic implications. Our analysis therefore concentrated mostly on the remaining two categories: openness making the AI race more closely competitive, and openness enabling wider engagement.

Regarding making the AI race more closely competitive: this has an important negative implication for the control problem, reducing the ability of a leading developer to pause or accept a lower level of performance in order to put in place controls. This could increase the amount of existential risk associated with the AI transition. Closer competition may also make it more likely that there will be a multiplicity of competing AIs; but the net strategic effect of this is unclear and may therefore have less decision weight than the no-option-of-slowing-down effect. There are also a bunch of implications from a more closely competitive AI race for the political problem – decreasing the probability that a small group will monopolize the benefits of advanced AI (attractive); decreasing the probability of a singleton (might be catastrophic); and having some ambiguous impact on the expected relative influence of status quo powers over the post-AI future – possibly increasing that influence in hardware-constrained scenarios and reducing it in software-constrained scenarios. Again, from an existential risk minimization perspective, the net import of these implications of openness for the political problem seems to be negative.**23**

Regarding openness enabling wider engagement: this has an important positive implication for the control problem, namely by enabling external researchers – who may have less bias and relatively more interest in the public good of safety – to work with state-of-the-art AI systems. Another way in which openness could have a positive effect on the control problem is by enabling better social planning and prioritization, although this benefit would not require openness about detailed technical information (only about AI projects' plans and capabilities).**24** If openness leads to wider engagement, this could also have implications for the political problem, by enabling better foresight and by increasing the probability of government control of advanced AI. Whether the expected value here would be positive or negative is not entirely clear. It may depend, for instance, on who would control advanced AI if it is not nationalized. On balance, however, one may perhaps judge the implications for the political problem of a wide range of actors gaining increased foresight to be positive in expectation. Again, we note that the relevant type of openness here is openness about capabilities, goals, and plans, not openness about technical details and code. Openness about technical details and code may have a weaker impact on general foresight, and it may reduce the probability of expropriation.

XXIII. Specific forms of openness

Openness can take different forms – openness about science, source code, data, safety techniques, or about the capabilities, expectations, goals, plans, and governance structure of an AI project. To the extent that it is possible to be open in some of these dimensions without revealing much information about other dimensions, the policy question can be asked with more granularity, and the answer may differ for different forms of openness.

XXIV. Science and source code

Openness about scientific models, algorithms, and source code is the focus of most the preceding discussion. One nuance to add is that the optimum strategy may depend on time. If AI of the advanced sort for which the control problem becomes critical is reasonably far off, then it may well be that any information that would be released now as a result of a more open development policy would have diffused widely anyway by the time the final stage is reached. In that case, the earlier main argument against openness of science and code – that it would make the AI development race more closely competitive and reduce the ability of a leading project to go slow – might not apply to present-day openness. So it might be possible to reap the near-term benefits of openness while yet avoiding the long-term costs, assuming a project can start out open and then switch to a closed development policy at the appropriate time. Note, however, that keeping alive the option of going closed when the critical time comes would remove one of the main reasons for favoring openness in the first place, namely the hope that openness reduces the probability of a monopolization of the benefits of advanced AI. If a policy of openness is reversible, it cannot serve as a credible commitment to share the fruits of advanced AI. Nevertheless, even people who do not favor openness at the late stages may favor openness at the early stages because the costs of openness there are lower.[25,26]

XXV. Control methods and risk analysis

Openness about safety techniques seems unambiguously good, at least if it does not spill over too much into other forms of openness. AI developers should be encouraged to share information about potential risks from advanced AI and techniques for controlling such AI. Efforts should be made to enable external researchers to contribute their labor and independent perspectives to safety research if this can be done without disclosing too much sensitive information.

XXVI. Capabilities and expectations

Openness about capabilities and expectations for future progress, as we saw, has a mixed effect, enabling better social oversight and adaptation while in some models risking to exacerbate the race dynamic. Some actors might attempt to target disclosures to specific audiences that they think would be particularly constructive. For example, technocrats may worry that wide public engagement with the issue of advanced AI would generate more heat than light, citing analogous cases, such as the debates surrounding GMOs in Europe, where it might appear as if beneficial technological progress would have been able to proceed with fewer impediments had the conversation been dominated more by scientific and political elites with less involvement from the public. Direct democracy proponents, on the other hand, may insist that the issues at stake are too important to be decided by a bunch of AI programmers, tech CEOs, or government insiders (who may serve parochial interests) and that society and the world is better served by a wide open discussion that gives voice to many diverse views and values.

XXVII. Values, goals, and governance structures

Openness about values, goals, and governance structures is generally welcome, since it should tend to differentially boost projects that pursue goals that are attractive to a wide range of stakeholders. Openness about these matters might also foster trust and reduce pressures to compromise safety for the sake of competitive advantage. The more that competitors feel that they would still stand to gain from a rival's success, the better the prospects for a collaborative approach or at least one in which competitors do not actively work against one another. For this reason, measures that align the incentives between different AI developers (particularly their incentives at the later stages) are desirable. Such measures may include cross-holdings of stock, joint research ventures, formal or informal pledges of collaboration,**27** endorsement of principles stating that advanced AI should be developed only for the common good, and other activities that build trust and amity between the protagonists.**28**

Endnotes

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1. Examples of complementary assets include: manufacturing capacity using related technologies, product distribution networks, after-sales service, marketing and brand assets, and various industry-specific factors (Greenhalgh and Rogers, 2010).

2. Other motivations include enjoyment, learning, and serving user needs (Lakhani and Wolf, 2005).

3. Patents require publication, but the pursuit of patent could still in some cases conflict with openness, for example if work in progress is kept hidden until it is developed to a point where it can be patented.

4. There are ongoing efforts (Destro Bisol et al., 2014) to make science even more open, with calls for requiring open access journal publication, pre-registration of studies, and making the raw data underlying studies available to other scholars. The trends towards increasing use of online preprint archives and scientist blogging also point in the direction of greater openness. The increasing use of patenting by universities might be an opposing trend (Leydesdorff et al. 2015), but the general pattern looks like a push towards greater openness in scientific research, presumably reflecting a belief among reformers that greater openness would promote scientific progress. The counterexample of increased patenting pertains to the part of academic research that is closest to the commercial world, involving areas of more applied research. It is possible that universities engage in patent-seeking for the same reason private firms do: to profit from the intellectual property. A university may thus take out a patent not because it believes that openness delays scientific progress but because it prefers to increase its own revenue (which it might then use to subsidize other activities, including some that may accelerate science).

5. '[t]he substantive findings of science ... are assigned to the community ... The scientist's claim to "his" intellectual "property" is limited to that of recognition and esteem' (Merton 1942, p. 121).

Later work has found very widespread support for this sharing norm among scientists (Louis et al. 2002; Macfarlane and Cheng 2008. See also Heesen (2015).

6. For some critiques of this model, see Park (2010), pp. 31f.

7. For an overview of the literature on the economic effects of philanthropic intervention on innovation see Engelhardt (2011) and Maurer (2012).

8. Specifically, it estimates annual economic impacts from technological transformations by 2025 in the following sectors: Automation of knowledge work: $5.2–6.7 trillion; Internet of things: $2.7–6.2 trillion; Advanced robotics: $1.7–4.5 trillion; Autonomous and near-autonomous vehicles: $.2–1.9 trillion; and 3D printing: $0.2–0.6 trillion (Manyika et al., 2013). These sectors also involve technologies other than AI, so not all of these impacts should be attributed to advances in machine intelligence. (On the other hand, AI will also contribute to economic impacts in many other sectors, such as the health sector.)

9. The early stage of the industrial revolution appears to be associated with a decline in average height, though the exact causes remain unclear and may also be related to urbanization (Steckel, 2009).

10. The same could happen if safety work is harder to parallelize (Muehlhauser 2014), so that it does not scale as well as capability work does when the contributor pool is expanded to include a greater proportion of independent and physically dispersed researchers.

11. At the moment, the AI safety field is probably growing more rapidly than the AI capability field. If this growth is exogenous, it may be desirable for overall progress to be slower to allow this trend towards a greater fraction of AI-related resources going into safety to culminate.

12. Existential risks from nature – such as asteroid impacts – are too small on the relevant timescale to matter in this context (Bostrom and Cirkovic, 2008). See also Beckstead (2015); Bostrom (2013, 2014a).

13. The case with respect to data is harder to assess, as it would depend on what kind of data is most critical to AI progress at the relevant stage of development. Currently, many important data sets are proprietary while many others are in the public domain.

14. For a model that is too simple to be realistic but which illustrates the point, suppose that key ideas arrive independently at some rate r with each researcher-year, and that k key ideas are needed to produce an AI. Then a lone researcher working for y years has a certain probability p

of having each idea (technically p = 1!e^!r"y), and probability p^k of building an AI. A group of n researchers working together have a joint rate r"n and a higher probability q of having each idea (q = 1!e^!r"n"y), and probability q^k of building an AI within y years. So the ratio of probability of success of the large group to the individual is (q/p)^k which gets larger as k increases.

15. For instance, one AI or coalition of AIs might make a technological breakthrough that affords a decisive strategic advantage.

16. This may be analogous to the ongoing debate between flu researchers (ingroup most immediately involved) and epidemiologists (a neighboring scientific outgroup) on the wisdom of continuing gain-of-function research to enhance, and subsequently study, the transmissibility of potential pandemic pathogens such as the avian flu virus (Duprex et al., 2015).

17. Just as for other open source development projects, there could be reasons for contributing other than an altruistic desire to supply a public good, and those reasons could favor contributing to AI effectiveness rather than AI safety. For example, working on AI effectiveness might be a better way to signal skill, or it might be more fun.

18. Most groups will probably regard themselves as exceptionally altruistic and safety-oriented whether or not they really are so. The present consideration could therefore easily support rationalizations.

19. In one simple model, however, increased transparency about capabilities – even if it reveals no information that helps AI design – would, in expectation, exacerbate the race dynamic and reduce the probability that the control problem will be solved (Armstrong et al., 2016). © 2017 The Authors Global Policy published by Durham University and John Wiley & Sons, Ltd. Global Policy (2017) Nick Bostrom 12

20. Although this paper is not especially long, it is quite dense, and many considerations that are here afforded only a few words could easily be the subject of an entire separate analysis on their own.

21. It is also possible that some of the structure of the present analysis is relevant for other macrostrategic questions and that it could thus case some indirect light on a wider set of issues.

22. For instance, an unsophisticated user might have a website which runs on a Linux server, but the server is maintained by a sophisticated sysadmin. The user experience of open source software also depends on how it interacts with proprietary software. For instance, many consumer devices use the open source Android operating system, but it typically comes bundled with a

variety of proprietary software. Many open source projects now function primarily as ways to structure joint R&D ventures between large companies to allow them to share development costs for consumer oriented projects (Maurer, 2012).

23. From the perspective of a person-affecting objective function (one that in effect privileges currently existing people) it is more plausible that a more closely competitive AI race would be desirable. A more closely competitive race would increase the chance that the benefits of AI will be widely distributed. At least some theories of prudential self-interest would seem to imply that it is far more important for an individual to be granted some (non-trivial) fraction of the resources of a future civilization (rather than none) than it is to be granted a large fraction (rather than a small fraction) – on the assumption individuals face diminishing marginal utility from resources. (Since the resource endowment of a future civilization is plausibly astronomically large, it would be sufficient to assume that diminishing returns set in for very high levels of resources.) See Bostrom (2014a).

24. A more open development process could also influence architecture in ways that would be relevant to the control problem, but it is unclear whether those influences would be positive or negative. As with some of the other factors discussed, even though there is currently no clear evidence on whether this factor is positive or negative, it is worth bearing in mind as potentially relevant in case further information comes to light.

25. On the other hand, if it is easier to switch from closed to open than the other way around, then there could be an important opportunity cost to starting out with openness rather than starting out closed and preserving the opportunity to switch to open later on.

26. Openness about data, that is, the sharing of valuable data sets, is in many ways similar to openness about science and source code, although sometimes with the added complication that there is a need to protect user privacy. In many cases, a data set is primarily relevant to a particular application and not much use to technology R&D (for which purpose many alternative data sets may serve equally well).

27. This may be augmented by the creation or identification of a trusted neutral third party that can monitor progress at different organizations, facilitate coordination at key points of the development process, and perhaps help arbitrate any disagreements that might arise.

28. Some technical work might also point towards opportunities to implement compromise solutions; see, e.g., ‘utility diversification’ in (Bostrom, 2014b).

References

Armstrong, S., Bostrom, N. and Shulman, C. (2016) 'Racing to the Precipice: A Model of Artificial Intelligence Development', *AI & SOCIETY*, **31** (2), pp. 201– 206.

Arrow, K. (1962) 'Economic Welfare and the Allocation of Resources for Invention, in Universities-National Bureau Committee for Economic Research, Committee on Economic Growth of the Social Science Research Council (ed.), *The Rate and Direction of Inventive Activity: Economic and Social Factors*. Princeton: Princeton University Press, pp. 609– 626.

Autor, D. H. (2015) 'Why Are There Still So Many Jobs? The History and Future of Workplace Automation', *Journal of Economic Perspectives*, **29** (3), pp. 3– 30.

Balkin, J. M. (2008) 'The Constitution in the National Surveillance State', *Minnesota Law Review*, **93** (1), pp. 1– 25.

Beckstead, N. (2016) 'Differential Technological Development: Some Early Thinking', [online] The GiveWell Blog. Available from: http://blog.givewell.org/2015/09/30/differential-technological-development-some-early-thinking [Accessed 8 November 2016].

Bessen, J. E. (2006) 'Open Source Software: Free Provision of Complex Public Goods', in J. Bitzer and P. J. H. Schroder eds. *The Economics of Open Source Software Development*. Amsterdam: Elsevier, pp. 57– 81.

Destro Bisol, G., Anagnostou, P., Capocasa, M., Bencivelli, S., Cerroni, A., Contreras, J. L. et al. (2014) 'Perspectives on Open Science and Scientific Data Sharing: An Interdisciplinary Workshop', *Journal of Anthropological Sciences*, **92** (1), pp. 179– 200.

Boldrin, M. and Levine, D. K. (2008) 'Perfectly Competitive Innovation', *Journal of Monetary Economics*, **55** (3), pp. 435– 453.

Bostrom, N. (2003) 'Astronomical Waste: The Opportunity Cost of Delayed Technological Development', *Utilitas*, **15** (3), pp. 308– 314.

Bostrom, N. (2004) 'The Future of Human Evolution', in C. Tandy ed. *Death and Antideath, Volume*

2: Two Hundred Years After Kant, Fifty Years After Turing. Palo Alto, CA: Ria University Press, pp. 339– 371.

Bostrom, N. (2006) 'What is a Singleton', *Linguistic and Philosophical Investigations*, **5** (2), pp. 48– 54.

Bostrom, N. (2013) 'Existential Risk Prevention as Global Priority', *Global Policy*, **4** (1), pp. 15– 31.

Bostrom, N. (2014a) *Superintelligence: Paths, Dangers, Strategies*. Oxford: Oxford University Press.

Bostrom, N. (2014b) 'Hail Mary, Value Porosity, and Utility Diversification', Technical report, Oxford University.

Bostrom, N. and Cirkovic, M. M. (2011) *Global Catastrophic Risks*. Oxford: Oxford University Press.

Bostrom, N., Douglas, T. and Sandberg, A. (2016) 'The Unilateralist's Curse and the Case for a Principle of Conformity', *Social Epistemology*, **30** (4), pp. 350– 371.

Boudreau, K. J. and Lakhani, K. R. (2015) 'Open' Disclosure of Innovations, Incentives and Follow-on Reuse: Theory on Processes of Cumulative Innovation and a Field Experiment in Computational Biology', *Research Policy*, **44** (1), pp. 4– 19.

Brynjolfsson, E. and McAfee, A. (2014) The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies. New York: WW Norton & Company.

Casadesus-Masanell, R. and Ghemawat, P. (2006) 'Dynamic Mixed Duopoly: A Model Motivated by Linux vs. Windows', *Management Science*, **52** (7), pp. 1072– 1084.

US Commodity Futures Trading Commission and US Securities & Exchange Commission (2010) 'Findings Regarding the Market Events of May 6, 2010', [online]. Washington D.C. Available from: https://www.sec.gov/news/studies/2010/marketevents-report.pdf [Accessed 6 January 2017].

Cohen, W. M. and Levinthal, D. A. (1989) 'Innovation and Learning: The Two Faces of R&D', *The Economic Journal*, **99** (397), pp. 569– 596.

Duprex, W. P., Fouchier, R. A., Imperiale, M. J., Lipsitch, M. and Relman, D. A. (2015) 'Gain-of-function Experiments: Time for a Real Debate', *Nature Reviews Microbiology*, **13** (1), pp. 58– 64.

Engelhardt, S. V. (2011) 'What Economists Know About Open Source Software – Its Basic Principles and Research Results', Jena Economic Research Paper 005.

Foushee, B. D. (2013) 'Prevalence of Reflexivity and Its Impact on Success in Open Source Software Development: An Empirical Study', MS thesis, Brigham Young University. Available from: http://scholarsarchive.byu.edu/etd/3570/ [Accessed 6 January 2017].

Future of Life Institute (2015) 'Autonomous Weapons: An Open Letter from AI & Robotics Researchers', [online]. Available from: http://futureoflife.org/open-letter-autonomous-weapons [Accessed 8 November 2016].

Galor, O. and Moav, O. (2004) 'From Physical to Human Capital Accumulation: Inequality and the Process of Development', *The Review of Economic Studies*, **71** (4), pp. 1001– 1026.

Goldman Sachs (2015) 'The Real Consequences of Artificial Intelligence', *Fortnightly Thoughts* (85). Available from: http://www.cognitivescale.com/wp-content/uploads/2015/03/FT-Artificial-Intelligence.pdf [Accessed 8 November 2016].

Greenhalgh, C. and Rogers, M. (2010) Innovation, Intellectual Property, and Economic Growth. Princeton: Princeton University Press.

Griffith, R., Redding, S. and Van Reenen, J. (2004) 'Mapping the Two Faces of R&D: Productivity Growth in a Panel of OECD Industries', *Review of Economics and Statistics*, **86** (4), pp. 883– 895.

Hanson, R. (1994) 'If Uploads come First', *Extropy*, **6** (2), pp. 10– 15.

Hann, I. H., Roberts, J., Slaughter, S. and Fielding, R. (2004) 'An Empirical Analysis of Economic Returns to Open Source Participation', Unpublished working paper, Carnegie-Mellon University.

Heesen, R. (2015) ‘Communism and the Incentive to Share in Science’, EPS15: 5th Biennial Conference of the European Philosophy of Science Association, Düsseldorf, Germany, 23–26 September.

Hirshleifer, J. (1971) ‘The Private and Social Value of Information and the Reward to Inventive Activity’, *The American Economic Review*, **61** (4), pp. 561– 574.

Lakhani, K. and Wolf, R. G. (2003) ‘Why Hackers Do What They Do: Understanding Motivation and Effort’, in J. Feller, B. Fitzgerald, S. Hissam and K. R. Lakhani (eds.), *Perspectives on Free and Open Source Software*. Cambridge: MIT Press.

LaVictoire, P., Fallenstein, B., Yudkowsky, E., Barasz, M., Christiano, P. and Herreshoff, M. (2014) ‘Program Equilibrium in the Prisoner's Dilemma via Löb's Theorem’, in S. Albrecht, S.

Barrett, J. Crandall, and S. Liemhetcharat (eds.), *AAAI-14 Workshop: Multiagent Interaction without Prior Coordination*, Québec Convention Center, Québec City, 28 July.

Levy, S. (2015) ‘How Elon Musk and Y Combinator Plan to Stop Computers From Taking Over’, [online]. Available from: https://backchannel.com/how-elon-musk-and-y-combinator-plan-to-stop-computers-from-taking-over-17e0e27dd02a [Accessed 8 November 2016].

Lerner, J. and Tirole, J. (2005) ‘The Economics of Technology Sharing: Open Source and Beyond’, *The Journal of Economic Perspectives*, **19** (2), pp. 99– 120.

Leydesdorff, L., Etzkowitz, H. and Kushnir, D. (2015) ‘The Globalization of Academic Entrepreneurship? The Recent Growth (2009–2014) in University Patenting Decomposed’, [online]. Available from: https://arxiv.org/pdf/1512.04214.pdf [Accessed 6 January 2017].

Louis, K. S., Jones, L. M., Anderson, M. S., Blumenthal, D. and Campbell, E. G. (2001) ‘Entrepreneurship, Secrecy, and Productivity: A Comparison of Clinical and Non-clinical Life Sciences Faculty’, *The Journal of Technology Transfer*, **26** (3), pp. 233– 245.

Macfarlane, B. and Cheng, M. (2008) ‘Communism, Universalism and Disinterestedness: Reexamining Contemporary Support among Academics for Merton's Scientific Norms', *Journal of Academic Ethics*, **6** (1), pp. 67– 78.

Manyika, J., Chui, M., Bughin, J., Dobbs, R., Bisson, P. and Marrs, A. (2013) *Disruptive Technologies: Advances That Will Transform Life, Business, and the Global Economy Vol. 12*. San Francisco, CA: McKinsey Global Institute.

Maurer, S. M. (2012) 'Penguin and the Cartel: Rethinking Antitrust and Innovation Policy for the Age of Commercial Open Source', *The Utah Law Review*, **2012** (1), pp. 269– 318.

Merton, R. K. (1942) 'Note on Science and Democracy, A. *Journal of Legal & Political Sociology*, **1** (1–2), pp. 115– 126.

Muehlhauser, L. (2014) 'Kathleen Fisher on High-assurance Systems', [online]. Available from: https://intelligence.org/2014/01/10/kathleen-fisher-on-high-assurance-systems/ [Accessed 8 November 2016].

Nosek, B. A., Alter, G., Banks, G. C., Borsboom, D., Bowman, S. D., Breckler, S. J. et al. (2015) 'Promoting an Open Research Culture', *Science*, **348** (6242), pp. 1422– 1425.

Park, W. G. (2010) 'Innovation and Economic Dynamics', Department of Economics, American University, Washington D.C. Available from: http://www.eolss.net/sample-chapters/c02/e6-154-19.pdf [Accessed 8 November 2016].

Perrow, C. (1984) Normal Accidents: Living with High Risk Technologies. Princeton: Princeton University Press.

Robb, J. (2011) 'Bloomberg vs. Occupy Wall Street #ows #openprotest', [online]. Available from: http://globalguerrillas.typepad.com/globalguerrillas/2011/11/2016-bloomberg-vs-occupy-wall-street-ows-openprotest.html [Accessed 8 November 2016].

Robb, J. (2016) 'Deep Maneuver (Autonomous Robotic Weapons)‘, [online]. Available from: http://globalguerrillas.typepad.com/globalguerrillas/2016/02/slow-maneuver-part-1-.html [Accessed 8 November 2016].

Saint-Paul, G. (2003) 'Growth Effects of Nonproprietary Innovation', *Journal of the European Economic Association*, **1** (2–3), pp. 429– 439.

Schmidt, K. M. and Schnitzer, M. (2003) 'Public Subsidies for Open Source? Some Economic Policy Issues of the Software Market', *Harvard Journal of Law & Technology*, **16** (2), pp. 473– 505.

Schumpeter, J. (1942) *Capitalism Socialism and Democracy*. New York: Harper and Brothers.

Shell, K. (1966) 'Toward a Theory of Inventive Activity and Capital Accumulation', *The American Economic Review*, **56** (1–2), pp. 62– 68.

Shell, K. (1967) 'A Model of Inventive Activity and Capital Accumulation', in K. Shell (ed.), *Essays on the Theory of Optimal Economic Growth*. Cambridge: MIT Press, pp. 67– 85.

Steckel, R. H. (2009) ''Heights and human welfare: Recent developments and new directions', *Explorations in Economic History*, **46** (1), pp. 1– 23.

United Nations Development Programme and Malik, K. (2014) *Human Development Report 2014: Sustaining Human Progress‐Reducing Vulnerabilities and Building Resilience*. New York: United Nations Development Programme.

Original Source: Bostrom, N. (2017). *Strategic Implications of Openness in AI Development*. Global Policy. Retrieved from https://www.nickbostrom.com/papers/openness.pdf

Singularity Theodicy and Immortality by Hohyun Sohn

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Abstract: Recent advances in technology have brought humanity to a unique point in history where theodicy is no more just a religious matter but also a matter of science and technology. Ray Kurzweil offers a non-religious Singularity theodicy of this-worldly subjective immortality (the survival of the soul after the dissolution of the body) with three strategies: the freezing strategy in cryonics, the cloning strategy in genetics, and the transference strategy in information technology. I argue that three challenges need to be met for the Singularity theodicy to be successful. The first challenge is related to the technological plausibility of human brain scanning and whether one can scan unconsciousness without making it into something other than unconsciousness. Based on the philosophies of Alfred North Whitehead and Derek Parfit, I offer the second criticism that the non-identity problem arises, due to personal identity being a temporal seriality of experiences between the biological person and the unloaded data. Lastly, even if intelligent patterns become immortal in the Singularity, this would not be what Christianity has called the immortality of the soul.

KEYWORDS: Singularity; Kurzweil; theodicy; immortality; personal identity; unconsciousness; temporal seriality; immortality of the soul; Deus sive machina

I. Introduction

Since the term "theodicy" was coined by the philosopher Gottfried Leibniz, the effort to answer questions of natural disasters, moral evils, and human finitude has been commonly referred to as theodicy (Leibniz 1952). Various religious answers have been suggested including free-will theodicy, aesthetic theodicy, educative theodicy, recompense theodicy, theodicy deferred, process theodicy, and so on (Green 1987). Yet our advances in technology have brought humanity to a unique point in history where theodicy is no more just a religious matter but also a matter of science and technology. People begin to think of the possibility that not God but technology will save us, and that death will be overcome not by a Deus ex machina but by a Deus sive machina. The mere possibility that technology will offer humans emancipation from the inevitability of death has significant consequences for the role of religions and Christianity in future civilization.

Recent projects on technology and death to relate human beings to a larger complex network-like ecosystem or social network of computers are called a “theodicy of networks” (Kera 2013). This form of theodicy is an attempt to gain personal immortality by assimilating the dead to the universe with the help of software, hardware, and biotechnologies. For instance, one version of theodicy of networks is “Mission Eternity”, a digital cemetery or cloud project by Etoy Corporation from Switzerland, which brings together a person’s life in the form of digital profiles or records and stores these data on computers of netizens to prevent a slow decay of information left by the dead into oblivion. “Biopresence” is another project of the afterlife by Shiho Fukuhara and Georg Tremmel, in which human DNA is implanted into a living tree as an alternative to the traditional graves and headstones. While the theodicy of networks envisions a form of “objective” immortality, other writers on technological development seem to promise what may be called a “subjective” immortality. This distinction is borrowed from process theologians. Lewis Ford and Marjorie Suchocki suggest the possibility of an individual’s subjective immortality, i.e., “the survival of the soul after the dissolution of the body,” without the loss of immediacy of personal feeling in God’s consequent nature even after death (Ford and Suchocki 1977, p. 1). Other process thinkers, including Lori E. Krafte, think that subjective immortality without further subjective experience after death is not possible in the Whiteheadian universe, because any postmortem experience will change one’s identity as a temporal seriality (Krafte 1979). Subjective immortality is a state of existence that allows an individual to avoid death or maintain personal consciousness after death.

To my knowledge, there has been no theodicy of this-worldly subjective immortality because there has never been a time when we have possessed some technological means to sustain ourselves beyond biological death. For instance, G.W.F. Hegel’s speculative theodicy has not considered the possibility of extinction of humanity, while A.N. Whitehead’s process theodicy has viewed human immortality as possible only objectively, viz., as realized values in God’s memory. However, recent advances in genetics, nanotechnology, robotics, artificial intelligence, etc., seem to have brought a fundamental change of attitude toward death. Ray Kurzweil, author of The Singularity Is Near, claims that death is not a natural or metaphysical necessity but an avoidable tragedy. He believes that humans are on the verge of conquering death. “We have the means right now to live long enough to live forever” (Kurzweil 2005, p. 371). He has popularized this non-religious idea of subjective immortality through accelerating future technological changes as follows:

> *Historically, the only means for humans to outlive a limited biological life span has been to pass on values, beliefs, and knowledge to future generations. We are now approaching a paradigm shift in the means we will have available to preserve the patterns underlying our existence. . . . We can expect that the full realization of biotechnology and nanotechnology revolutions will enable us to eliminate virtually all medical causes of death. As we move toward a nonbiological existence, we will gain the means of "backing ourselves up" (storing the key patterns underlying our knowledge, skills, and personality), thereby eliminating most causes of death as we know it.* (Kurzweil 2005, p. 323)

It is tempting to dismiss Kurzweil's Singularitarianism as some sort of pseudo-religious cult of odd scientists. My purpose here is not to criticize his vision as a false promise out of hand. It is incumbent on religious thinkers, in their theological and ethical fields, to examine the religious and metaphysical implications of human enhancement technologies in light of their theologies. By characterizing Kurzweil's technological vision of subjective immortality as a "Singularity theodicy," I attempt to highlight this interdisciplinary nature of constructive theology as a method of doing theology that takes seriously religious traditions as well as the ideas and writings of various philosophies and modern natural sciences in order to articulate what it means to be a human in the world (Kaufman 1993, p. 29). The term theodicy itself demonstrates this interdisciplinary nature. Since Leibniz's philosophy introduced the category of metaphysical evil to the traditional categories of moral and natural evil, the issue of death as the original creaturely imperfection has become a theodicy problem in monotheistic religions. With the advent of sociology of religion, Max Weber extended the use of the term theodicy to any theistic or non-theistic attempt to render human suffering, evil, and death intelligible (Laato and de Moor 2003, p. x). The two editions of the Encyclopedia of Philosophy provide another recent example of this interdisciplinary approach. Antony Flew's 1967 article, "Immortality," in the first edition studies three traditional doctrines of immortality: the immortal soul doctrine of Platonism, the reconstitution doctrine of Christianity, and the shadow-man doctrine as an attempt to combine the other two doctrines (Borchert 2006, pp. 602–16). In addition to these philosophical or religious approaches, Garrett J. DeWeese's 2005 "Addendum" includes Kurzweil's "cybernetic immortality" as a nontraditional technological conception of immortality: "In The Age of Spiritual Machines (1999), Ray Kurzweil predicts such immortality will be achieved by uploading the contents of our brains into ever-better computers" (Borchert 2006, p. 617). Kurzweil's proposals of cybernetic immortality therefore constitute a form of theodicy with religious implications, which, even if he does not fully recognize them, call for theological exploration.)

In what follows, I outline Kurzweil's three strategies for this technological immortality and I raise some objections to them: (1) the freezing strategy in cryonics, (2) the cloning strategy in genetics, and (3) the transference strategy in information technologies. First, I argue that the freezing strategy is a stop-gap measure insofar as it requires other longevity technologies to be available in the future. Second, I argue that the cloning strategy does not succeed since the future survival of my clone is identical with my own personal survival. Third, I suggest that in his interpretation of the transference strategy as the most feasible strategy of this-worldly subjective immortality, Kurzweil needs to address three additional problems: the technological plausibility of scanning human unconsciousness, the philosophical issue of personal identity, and the theological issue of human soul having her origin in God.

II. Three Strategies of the Singularity Theodicy

II.I. Freezing Strategy

The first strategy of freezing is described by Kurzweil as "the process of preserving by freezing a person who has just died, with a view toward 'reanimating' him later when the technology exists to reverse the damage from the early stages of the dying process, the cryonic-preservation process, and the disease or condition that killed him in the first place" (Kurzweil 2005, p. 384). For instance, the Alcor Life Extension Foundation claims that we can suspend the death process through cryonic freezing procedure within the first 15 minutes after the heart stops, preserving critical information in the brain for future restoration (Alcor Life Extension Foundation 2019). The success of this cryonic freezing depends on achieving a high-fidelity preservation of the body, and especially the brain viewed as the locus of memory and personality.

Some religious thinkers view the cryonic program of freezing the dead with the plan to resuscitate as a scientific expression of the Christian doctrine of bodily resurrection. Relying on St. Paul's notion of spiritual body, Calvin Mercer claims that "theologians objecting that a restored, even robotic, body is not theologically acceptable would need to explain how they can accept Paul's 'spiritual body,' which also has a different composition" (Mercer 2017). While

Mercer sees no difference of identity between the dead and the reanimated, Kurzweil offers a more modest view that the reanimated person will not be the same person but someone else or "Ray 2," given the fact that new materials and even entirely new neuromorphically equivalent systems will be rebuilt (Kurzweil 2005, p. 384). Kurzweil's distrust of biology led to his withdrawing from this freezing strategy, despite the fact that this strategy is arguably the most attractive from the perspective of maintaining personal identity. In the final analysis, this 'Egyptian' solution of a 'cryonic pyramid' is not a solution at all but a postponement of solution. Like a postponed theodicy that delays solutions of evil to the postmortem afterlife or what Spinoza in his Ethics calls "the sanctuary of ignorance" (Spinoza 1985, p. 443), it does not overcome death itself but postpone the solution to the future. In sum, the freezing strategy is a stop-gap measure at best until other longevity technologies are available to humanity.

II.II. Cloning Strategy

One major proponent of longevity research, Aubrey de Grey, believes that within the next several decades scientists will develop gene therapies that will increase the efficiency of cellular metabolism and reverse human aging. He calls this concept "longevity escape velocity" (de Grey 2007, p. 331). He considers the issue of aging or death as a maintenance problem of the body in analogy with the aging of a car or a building. Unlike de Grey who focuses on biomedical or gene therapies to lengthen human lifespan, Kurzweil thinks that genetic cloning provides a better chance of human immortality. Cloning is a process of producing genetically identical copies of a biological entity. Kurzweil hopes that cloning technologies will solve many problems like extinction of animal species and famine. Animal reproductive cloning has already been proven to be possible in the cases of sheep (1997), mouse (1998), horse (2003), cat (2004), and dog (2006). Furthermore, human cloning will possibly overcome even death and finitude itself. "There is no doubt that human cloning will occur," says Kurzweil, "as a very weak form of immortality" (Kurzweil 2005, p. 222).

Apart from the issues of technological possibility of human cloning and its ethical implications, the future survival of my clone is not identical with my own personal survival. Clones and twins have no substantial difference of ontological status in regard to personal identity here. Whether he be my conventional biological twin or my genetically cloned twin, he is not me after all. Neither method of duplication guarantees what we have called subjective immortality above. I will address the issue of personal identity when Kurzweil's transference strategy is discussed, but this non-identity problem of cloning is in fact Kurzweil's own position as well. "There's no issue of philosophical identity with genetic cloning, since such clones would be different people, even more so than conventional twins are today" (Kurzweil 2005, pp. 224–25). In that sense, the second cloning strategy offers not even a "very weak" form but no form of subjective immortality at all. Furthermore, the self-modifying effect of human cloning is perhaps an act of "species suicide" (Heimbach 1998). For these reasons, Kurzweil prefers "mental cloning" to "physical cloning," viz. the strategy of transference (Kurzweil 2005, p. 224).

II.III. Transference Strategy

Unlike de Grey's biological or genetic solutions, Kurzweil believes that the need for the human biological body will become obsolete as scientists reverse engineer the human brain and transfer consciousness to virtually immortal hardware. This transference strategy can be analyzed from three perspectives: technological possibility, philosophical issue of identity, and religious notion of the soul. First, is it technologically plausible to transfer or port a person's identity to a computational substrate? Calling himself a "patternist" who views a person's identity as the informational patterns of an individual mind, and following a Buddhist ontology that human consciousness is the locus of reality or personalness, Kurzweil sees no technological hindrance in principle to uploading the patterns of personal identity or what he calls "backing ourselves up" into a supercomputer (Kurzweil 2005, p. 388). "This process would capture a person's entire personality, memory, skills, and history" without any loss, as the brain scanning and uploading technologies will increase in resolution and accuracy at exponential pace (Kurzweil 2005, p. 199).

The second important question will be "whether or not an uploaded human brain is really you" (Kurzweil 2005, p. 201). In contrast to the freezing or cloning strategies, he believes that the strategy of gradual transference will not give rise to the issues of personal identity. As we can transfer our personal data files from an older computer to a new one, we can also transfer our informational patterns from a biological brain to a non-biological substrate. "There will be no 'old Ray' and 'new Ray,' just an increasingly capable Ray," in this process of gradual transference (Kurzweil 2005, p. 202). Lastly, and most importantly, can we consider this uploaded human brain as what Christianity has long called the soul? While Kurzweil does not address the theological term "soul" in a direct manner, religious nuances of his transference argument are unmistakable. A principal role of past religion has been to rationalize the soul's death, Kurzweil says, and “a new religion” of Singularitarianism envisions the soul’s goal as becoming part of the universe which is gradually saturated or spiritualized with infinite divine intelligence (Kurzweil 2005, p. 375). It is no accident that Michael E. Zimmerman places Kurzweil in the philosophical linage of Hegel who interprets the world history as God’s self-actualization process of theosis from petrified intelligence of matter to the community of spirits (Zimmerman 2008). The destiny of the universe is to become a Deus sive machina, and the immortality of the soul is to become part of this destiny.

III. Three Challenges to the Singularity Theodicy

III.I. Technological Dimension: The Issue of Unconsciousness

Kurzweil’s transference strategy raises important problems in three areas. The first problem is related to the technological plausibility that human brain scanning as a form of mental cloning will port “a person’s entire personality, memory, skills, and history” to a future non-biological body without loss (Kurzweil 2005, p. 224). Kurzweil and evolutionary psychologists approach the human brain with a computational model of mind, made up of numerous functional mechanisms such as language-acquisition modules, sex-specific mating preferences, and so on. This view is based on the assumption that the brain functions as a computer with circuits (Tooby and Cosmides 2005, p. 6). Yet it is not clear whether this mental computer model of human mind can address the issue of unconsciousness unless the unconscious mind is to be reduced to information or data.

Such a reduction is unacceptable in the view of many writers. C.G. Jung argues that the “personality as a total phenomenon does not coincide with the ego, that is, with the conscious personality” (Jung 1959, p. 5). Our consciousness is a very small portion of the contents and processes of our mind. Jung’s depth psychology views the mind as having multiple psychic strata: (1) the Ego (consciousness), (2) the Shadow, (3) Anima and Animus, and (4) the Self (unconsciousness). Furthermore, there are at least three further sub-groups within unconsciousness: “first, temporarily subliminal contents that can be reproduced voluntarily (memory); second, unconscious contents that cannot be reproduced voluntarily; third, contents that are not capable of becoming conscious at all” (Jung 1959, p. 4). While the first two of memory or decayed memory are perhaps knowable through technology, the third type of deep unconsciousness can be viewed as the unknowable or unpatternizable whether it be either personal or collective. Yet Jung believes that this vast extra-conscious territory of deep unconsciousness is crucial in the formation of any individuation process. Following Jung, I argue that human brain scanning cannot patternize what is essentially unpatternizable in the mind or "not capable of becoming conscious at all" without substantial loss of personalness. Technology cannot scan and upload information that the mind cannot formulate. There will be always a non-thematic or extra-conscious background in the mind as mystery beneath consciousness, which is other than informational patterns. This then is not merely a matter of technological advance but a deeper issue of logical compatibility. You cannot 'square a circle,' without making it into something other than a circle. Likewise, you cannot patternize unconsciousness, without making it into something other than unconsciousness.

Other religious thinkers have also identified an extra-conscious dimension of mystery in the soul. Impressed by Hindu and Buddhist ideas of karma, for instance, John Hick regards the idea of transmigration of souls as plausible at least in the general form of "an unconscious thread of memory" of each life with a series of previous lives (Hick 1976, p. 305). Here, karma is a postmortem substratum of individual dispositions of unconsciousness beyond the death of the individual. In his work, What Computers Can't Do, Hubert Dreyfus also argues that computers lack an "unconscious background of commonsense knowledge" that is essential to any formation of human identity (Dreyfus 1972, p. 158). No matter how efficiently computers can process informational patterns or data, they cannot replicate the unconscious instincts of human beings. It is far from clear whether an algorithm simulating unconsciousness can be designed. Even if that is possible, it will not be the saving of 'my' own unconsciousness, which defies any patternizing scanning since it is unpatternizable and hopelessly undetermined or indeterminate. I want to add that we must think of the possibility of selective backing-up as well. It is plausible that brain scanning may allow us to choose the mental makeup of our future self, enhancing desirable parts while deleting undesirables. Whether the selective uploading be voluntary or involuntary, it will not be the transference of entire personality. When we selectively back up our consciousness and mix it with the computational power of intelligent machine, perhaps we may not upgrade ourselves but end up "downgrading humans" (Harari 2017, p. 368).

III.II. Philosophical Dimension: Personal Identity as a Temporal Seriality

I understand personal identity as a temporal seriality of experiences, based on the philosophies of Alfred North Whitehead and Derek Parfit. According to Whitehead's metaphysics, a person is a society of actual occasions or personal experiences serially organized, viz., "a unity in life of each man, from birth to death" (Whitehead 1933, p. 240). A mere lump or aggregation of experience alone does not make diverse actual occasions into a personal identity. What is further required is a principle of seriality, which organizes experiences into a unique thread of personal history. This seriality principle is important because it has a fundamental impact on the very tonality of our experiences. Suppose that you enjoy a meal. According to the seriality principle, "the antecedent nature of the meal, and your initial hunger" will have impact on your subsequent experience of the meal, which becomes a part of your identity (Whitehead 1951, p. 686). This is why our identity is a historical or serial route of actual occasions or experiences. "The one individual is that coordinated stream of personal experiences, which is my thread of life or your thread of life" (Whitehead 1938, pp. 221–22). On this view, there is no single subsisting Cartesian consciousness but the self-identity emerges through various experiences organizing themselves into a temporal serial nexus.

Similarly, Derek Parfit bases the problem of personal identity on the "Time-Dependence Claim: If any particular person had not been conceived when he was in fact conceived, it is in fact true that he would never have existed" (Parfit 1984, p. 351). Suppose that a 14-year-old girl chooses to have a baby and she gives her child a bad start in life due to the mother's early age. If this girl had waited for several years, she would have given her child a better start in life. In one sense, this girl's decision was worse for her child. Yet, Parfit argues that we cannot claim the decision was worse or morally reprehensible for her child. If this girl does not have her child now but waits and has him later, he will not be the same particular child. Parfit calls this issue of personal identity over time as the "Non-Identity Problem" (Parfit 1984, p. 359). For each person's identity is essentially dependent on one's unique history of experiences in time.

We can apply Whitehead's principle of temporal seriality and Parfit's time-dependence claim to Kurzweil's Singularity theodicy. Applying Parfit's insight that "identity is time dependent" to the issue of human cloning, for instance, Jan C. Heller asserts that any cloned person would in fact be "a new biological entity" (Heller 1998). Although a human clone may share the same genetic material, the natural or social environment also plays an important role in how the person turns out. My clone will never repeat my own unique situation in temporal seriality. Despite his concession that this non-identity problem is applicable to both the freezing and cloning strategies, Kurzweil thinks that "our gradual transfer of our intelligence" to a non-biological substrate will not result in the situation of non-identity but a single enhanced person: "There will be no 'old Ray' and 'new Ray,' just an increasingly capable Ray" (Kurzweil 2005, pp. 201–2), as we have heard above. His strategy of gradual transference looks simple and persuasive enough, as we can also gradually replace parts of our body without losing our identity after all. However, this strategy is in fact full of ambiguities, analogous to the other two. If gradual transference means multiple transferences, this will still face the same non-identity problem. Suppose that the biological Ray decides to brain scan and upload some part of his mind to a supercomputer, resulting in Ray 2. Ray 2 will have its own unique history from the very moment of scanning. If the biological Ray decides to scan multiple times after ten or twenty years, the result will be a curious coexistence of many Rays: the biological Ray, Ray 2, Ray 3, and so on. Each Ray will enjoy his own irreplaceable personality due to the principle of temporal seriality and the time-dependence claim. The strategy of gradual-multiple transference does not solve the non-identity problem, even if each new scanning is a kind of overriding of the old Rays. There will always be a chasm of non-identity between the biological Ray and the unloaded Rays. We can never upload ourselves without leaving behind ourselves. Without the preservation of one's biological identity with its temporal seriality, which will only fulfill its historical route at the moment of death, the Singularity theodicy and its promise of subjective immortality will sound empty.

III.III. Theological Dimension: Soul as God's Creation

In the history of Christian theology, there have been two major ideas of the postmortem condition for individuals after death: the resurrection of the body and the immortality of the soul. I leave the Christian faith in the resurrection of the body—which is the dominant theological position of mainline Christianity—untouched, since this topic deserves a separate investigation beyond the limited scope of this article. I will focus on only the latter here. In other words, I do not attempt to discredit the Singularity theodicy of subjective immortality based on the inseparability of body and soul, as suggested in St. Thomas Aquinas (1975) dictum that "the soul is united to the body as its form" (Summa Contra Gentiles 2.83.9). Granted that the soul can be separated from the body, my third challenge is whether Kurzweil's cybernetic immortality offers something analogous to the vision of Christianity on the immortality of the soul. Is it what Christianity calls the immortality of the soul?

The soul is a notion with immense dignity in the Western civilization. In philosophy, Plato's dialogues advocate the pre-existence of souls before they are born into this world (Phaedo 65c). Similar to this Platonic doctrine of the immortality of the soul, early Christian theologians have developed two major views on the origin of the soul: traducianism and creationism. (Tertullian 1950), founder of traducianism, claims that a single human soul of Adam is originally created by God and transmitted to the children by the parents in the process of reproduction. Against a materialistic view of the soul's origin to be a result of an emanation from matter, Tertullian teaches that "the soul has its origin in the 'breath' of God and did not come from matter" (De Anima 3.4). Unlike Plato's emphasis on the soul's divinity, Tertullian also stresses the creatureliness of the soul. Most Christian theologians adopt a position of creationism that a person's soul is directly created by God at the moment of birth. For instance, St. Thomas views the creation of the human soul as "the prerogative of God alone" (SCG 2.87.3), saying that "God created a soul specifically for each one, and neither created them all together, nor united one to different bodies" (SCG 2.83.38).

Even if creationism has been dominant in recent centuries, traducianism remains an open option for Christian theology. "None of these views may be rashly affirmed," says (Augustine 1953) (De Libero Arbitrio 3.21.59). Despite these differences of traducianism and creationism, however, the two views share the common faith in God's creation as the soul's origin. Whether my soul be the original breath of God in Adam or God's subsequent creation at the very moment of my biological birth, it is the result of divine creative action. God alone creates the human soul/souls as a Singularity in the universe. Here lies the dignity of the human soul. Helmut Thielicke has coined a phrase "alien dignity" (dignitas aliena) to express this unique nature of the human soul as follows: "The basis of human dignity is seen to reside not in any immanent quality of man [sic] whatsoever, but in the fact that God created him [sic]" (Thielicke 1970, p. 172). Pannenberg also suggests this fellowship of the soul with God as "the basis of the inalienable dignity of each human person" (Pannenberg 1994, p. 176). Every soul has alien dignity of creatureliness.

In contrast, Kurzweil's Deus sive machina does not create souls but just harvests them. Given his view of persons as patterns, this harvest or uploading may be not even that of souls but information. "Immortality" may seem like a misplaced term here. While the immortality of the soul is more than mere duration of consciousness in Christianity, Kurzweil uses the word in terms of the preservation of patterned information without having a recognizably divine origin. I have also argued above that personal identity may be related to Whitehead's seriality principle and Parfit's time-dependence claim. In Christianity, this seriality or time-dependence starts with the creation of the soul. Since the uploaded brain will have neither this ontological status of divine origin nor a complete seriality without the soul at its very beginning, Kurzweil's promise of subjective immortality is unfulfilled. As the merging process of uploading continues, "we stand on the edge of disappearing as individuals" (McKibben 2003, p. 46). In sum, the Singularity theodicy starts as an anthropocentric promise of subjective immortality, but it ends up as a de-anthropocentric theodicy of objective immortality instead. It is like changing horses in the middle of the race.

IV. Conclusions

This paper outlined three strategies of Kurzweil's Singularity theodicy and has raised three objections to them, namely, (1) that the freezing strategy is an interim solution in need of other longevity technologies, (2) that the cloning strategy does not guarantee the identity between my clone's future survival and my own personal survival, and (3) that the transference strategy needs to elaborate additional issues of unconsciousness, personal identity, and the origin of the soul.

References

Alcor Life Extension Foundation. 2019. What is Cryonics? Available online: https://alcor.org/AboutCryonics/index.thml (accessed on 5 January 2019).

Aquinas, St. Thomas. 1975. *Summa Contra Gentiles. Book Two: Creation*. Notre Dame: University of Notre Dame Press.

Augustine. 1953. On Free Will. In *Augustine: Earlier Writings*. Edited by John H. S. Burleigh. Philadelphia: The Westminster Press.

Borchert, Donald M., ed. 2006. *Encyclopedia of Philosophy*, 2nd ed. Detroit: Thomson Gale.

de Grey, Aubrey. 2007. *Ending Aging: The Rejuvenation Breakthroughs That Could Reverse*

Human Aging in Our Lifetime. New York: St. Martin's Press.

Dreyfus, Hubert. 1972. *What Computers Can't Do*. New York: MIT Press.

Ford, Lewis S., and Marjorie Suchocki. 1977. A Whiteheadian Reflection on Subjective Immortality. *Process Studies* 7: 1–13.

Green, Ronal M. 1987. Theodicy. In *The Encyclopedia of Religion*. Edited by Mircea Eliade. New York: MacMillan, vol. 14, pp. 430–41.

Harari, Yuval Noah. 2017. *Homo Deus: A Brief History of Tomorrow*. New York: Harper Collins.

Heimbach, Daniel R. 1998. Cloning Humans: Dangerous, Unjustifiable, and Genuinely Immoral. *Valparaiso University Law Review* 32: 633–60.

Heller, Jan C. 1998. Religious Perspectives on Human Cloning: Revisiting Safety as a Moral Constraint. *Valparaiso University Law Review* 32: 661–78.

Hick, John. 1976. *Death and Eternal Life*. London: Collins.

Jung, Carl G. 1959. *Aion: Researches into the Phenomenology of the Self*. Princeton: Princeton University Press.

Kaufman, Gordon D. 1993. *In Face of Mystery: A Constructive Theology*. Cambridge: Harvard University Press.

Kera, Denisa. 2013. Designing for Death and Apocalypse: Theodicy of Networks and Uncanny Archives. *The Information Society* 29: 177–83.

Krafte, Lori E. 1979. Subjective Immortality Revisited. *Process Studies* 9: 35–36.

Kurzweil, Ray. 2005. *The Singularity Is Near: When Humans Transcend Biology*. New York: Penguin Books.

Laato, Antti, and Johannes C. de Moor, eds. 2003. *Theodicy in the World of the Bible*. Leiden and Boston: Brill.

Leibniz, Gottfried Wilhelm. 1952. *Theodicy: Essays on the Goodness of God, the Freedom of Man and the Origin of Evil*. New Haven: Yale University Press. First published 1710.

McKibben, Bill. 2003. *Enough: Staying Human in an Engineered Age*. New York: Henry Holt & Co.

Mercer, Calvin. 2017. Resurrection of the Body and Cryonics. *Religions* 8: 96.

Pannenberg, Wolfhart. 1994. *Systematic Theology*. Grand Rapids: Eerdmans, vol. 2.

Parfit, Derek. 1984. *Reasons and Persons*. Oxford: Oxford University Press.

Spinoza, Benedictus. 1985. *The Collected Works of Spinoza*. Princeton: Princeton University Press, vol. 1.

Tertullian. 1950. On the Soul. In *The Fathers of the Church: A New Translation*. Washington, DC: The Catholic University of America Press, vol. 10.

Thielicke, Helmut. 1970. The Doctor as a Judge of Who Shall Live and Who Shall Die. In *Who Shall Live?* Edited by Kenneth Vaux. Philadelphia: Fortress Press.

Tooby, John, and Lisa Cosmides. 2005. Conceptual Foundations of Evolutionary Psychology. In *The Handbook of Evolutionary Psychology*. Hoboken: Wiley.

Whitehead, Alfred North. 1951. Immortality. In *The Philosophy of Alfred North Whitehead*. Edited by Paul Arthur Schilpp. New York: Tudor Publishing Company. First published in 1941.

Whitehead, Alfred North. 1933. *Adventures of Ideas*. New York: Macmillan Company.

Whitehead, Alfred North. 1938. *Modes of Thought*. New York: Macmillan Company.

Zimmerman, Michael E. 2008. The Singularity: A Crucial Phase in Divine Self Actualization? *Cosmos and History* 4: 347–70.

Original Source: Sohn, H. (2019, March 6). *Singularity Theodicy and Immortality*. Religions. Retrieved from https://www.mdpi.com/2077-1444/10/3/165

C. S. Lewis and Jacques Ellul on Christianity, Science, Technology, and Government by Richard Riss

Prof. Richard Riss (Pillar College)

C. S. Lewis (1898-1963) and Jacques Ellul (1912-1994) specialized in differing academic fields, living and working on different sides of the English Channel. C. S. Lewis was Professor of Medieval and Renaissance Literature at Cambridge University, England, previously having become distinguished at Oxford, whereas Jacques Ellul, the French Christian sociologist, political scientist, and theologian, was Professor of Law and History at the University of Bordeaux's law school and its Institute of Political Studies.

Despite these differences, C. S. Lewis and Jacques Ellul had a number of things in common. Both were twentieth-century scholars, highly respected by their peers and by the general public, whose careers overlapped for a period of about twenty-five years beginning in the 1930s. Lewis began his career in 1925, and Ellul, fourteen years younger than Lewis, remained active as a scholar from 1937 until his death in 1994. In the midst of an extremely secular academic and intellectual climate, both scholars dedicated many decades of their lives integrating Christian faith in various ways with their academic work.

Ellul spent his life studying and writing about matters of sociology, law, politics and history, and the ways in which these particular fields related to Christian faith, producing over fifty volumes on these topics. C. S. Lewis, for his part, specialized in Medieval and Renaissance literature, writing close to seventy fiction and non-fiction books, helping to make Christianity accessible, not only to the world of scholarship, but also to the general public. Both of these men considered themselves lay theologians, yet they probably knew more theology than many, if not most, professional theologians. Both were highly conversant in the areas of history and philosophy, and both made use of these fields, as well as their own, to assist readers in their understanding of Christianity and the ways in which it relates to the world of scholarship.

It is intriguing that both had dramatic conversion experiences at approximately the same time. C. S. Lewis wrote, "In the Trinity Term of 1929 I gave in, and admitted that God was God, and knelt and prayed: perhaps, that night, the most dejected and reluctant convert in all England. I did not then see what is now the most shining and obvious thing; the Divine humility which will accept a convert even on such terms. The Prodigal Son at least walked home on his own feet. But who can duly adore that Love which will open the high gates to a prodigal who is brought in kicking, struggling, resentful, and darting his eyes in every direction for a chance of escape?"[1]

In approximately the same year, Jacques Ellul had what he described as "a very brutal and very sudden conversion,"[2] and professed himself a Christian. He was about seventeen or eighteen years old, spending the summer with friends in Blanquefort, France.

Ellul has recently been labeled a "Christian anarchist."[3] However, Ellul's book entitled *Anarchy and Christianity* (1991) was merely an attempt on his part to enable anarchists and Christians to understand one another and engage in dialogue. He stated in the introduction to this work that, on the one hand, he was not trying to convert anarchists to the Christian faith, but on the other hand, he was "not in any way trying to tell Christians that they ought to be anarchists."[4] Rather, he was striving for understanding between these two groups. Ellul did admit that there were times when he was attracted to anarchism, but as he wrote, "there was one insurmountable obstacle—I was a Christian."[5] At another time in his life, he was attracted to another movement closely related to anarchism known as Situationism,[6] but again, he wrote, "since I was a Christian, I could not belong to their movement."[7] Ellul's occasional attraction to anarchism can be attributed to his realization as a Christian that the kingdoms of this world are necessarily imperfect, and as a part of the world system, inescapably suspect, referring to the "world in which we are living" as "partly the work of man and partly the work of demons, or the powers."[8] He believed that the kingdoms of this world are a necessary evil at this time, but that they are temporary, pending the time of the full establishment of the kingdom of God on earth through Jesus Christ.[9]

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[1]C. S. Lewis, *Surprised by Joy* (London: Fontana Books, 1959), 183.
[2]Jacques Ellul and Willem H. Vanderburg, ed., 3d ed., *Perspectives on our Age: Jacques Ellul Speaks on His Life and Work* (Toronto: Canadian Broadcasting Corporation, 1981), 11.
[3]"Jacques Elul . . . was a . . . professor who was a noted Christian anarchist," Wikipedia article entitled "Jacques Ellul," referenced April 25, 2018, https://en.wikipedia.org/wiki/Jacques_Ellul.
[4]Jacques Ellul, *Anarchy and Christianity* (Eugene, Or.: Wipf & Stock, 1991), 4.
[5]Ellul, *Anarchy and Christianity*, 2.
[6]The Situationists, or the "Situationist International" was an organization of social revolutionaries consisting of avant-garde intellectuals, artists, and political theorists who were prominent in France and other parts of Europe during the mid-twentieth century.
[7]Ellul, *Anarchy and Christianity*, 3.
[8]Jacques Ellul, *False Presence of the Kingdom* (New York, N.Y.: The Seabury Press, 1972), 38.
[9]Jacques Ellul, *The Presence of the Kingdom* (Colorado Springs, Co.: Helmers & Howard, 1989), 37, 38, 42, 43, 71.

However, Ellul made it clear that he was not an anarchist. In his book *The Political Illusion* he indicated that he had never called "apolitism" a virtue. He wrote, "My aim never was to lead the reader in the direction of apolitism. . . . Nor is my aim to demonstrate the uselessness of political affairs."[10]

Ellul tended to ridicule the anarchist notion that the individual could escape the power of the state and live apart from it. At one point, he wrote, "To say that freedom simply means that the individual can escape the power of the state and decide for himself on the sense of his life and works seems in one way a simplistic, ridiculous, and adolescent reaction."[11]

Christian anarchists are defined as those who "denounce the state, believing it is violent, deceitful and, when glorified, idolatrous,"[12] but Ellul, while recognizing the imperfections of the state and understanding the dangers inherent in glorifying it, did not denounce it. In his work, *The Ethics of Freedom*, Ellul offered the following opinion: "If, then, the solitude of power is to be shattered in order that political balance may be preserved, the challenger must not come from the political sphere and his opposition must respect the existence of the state in order to be accepted. The Christian seems to be the only one who meets these two conditions. He recognizes that power is from God, so that there can be no question of suppressing it. But he is within another sphere of reference and it is from within this sphere that he can engage in dialogue."[13] For Ellul, therefore, because political power is from God, it must not be suppressed. Nevertheless, Christians have another sphere of reference, and from within that sphere of reference, they are able to engage in dialogue with those who abuse power. There would never be any attempt to suppress the state, nor would there be any denunciation of it. If there were an abuse of power by a state, then the existence of its power would still be respected as God-given though temporary, and criticisms of that power would be given in the spirit of compassion both for the abuser of power and for those abused by it.

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[10]Jacques Ellul, *The Political Illusion* (Eugene, Or.: Wipf & Stock, 1967), 201-202.
[11]Ellul, *The Political Illusion*, 16.
[12]Wikipedia article entitled "Christian anarchism," referenced April 25, 2018, https://en.wikipedia.org/wiki/Christian_anarchism.
[13]Jacques Ellul, *The Ethics of Freedom* (Grand Rapids, Mich.: William B. Eerdmans Company, 1976), 386.

Ellul did not denounce the state, but he was certainly suspicious of it, recognizing as a Christian that all of humanity is fallen and susceptible to doing evil. He would undoubtedly have agreed with Sir John Dalberg-Acton, who wrote to Bishop Mandell Creighton on April 5, 1887 both that "power tends to corrupt, and absolute power corrupts absolutely," and that "great men are almost always bad men."

Ellul was thus fully aware that the Prince of this world and the powers thereof, is Satan. He wrote, "The political, economic and technological world is the world which the Gospel of John speaks of as radically lost, radically the enemy of God: and its works are not good works. The Prince of this world is still Satan. He wields an extraordinary power even when vanquished. . . . He continues to have authority over the political powers, and Jesus in no way disputes that point with him."[14]

Many of the ideas that Ellul expressed regarding government may also be found in the works of C. S. Lewis, especially an article he wrote for *The Observer*, published July 20, 1958, in which he wrote, "One school of psychology regards my religion as a neurosis. If this neurosis ever becomes inconvenient to Government, what is to prevent my being subjected to a compulsory 'cure'? It may be painful; treatments sometimes are. But it will be no use asking, 'What have I done to deserve this?' The Straightener will reply: 'But, my dear fellow, no one's blaming you. We no longer believe in retributive justice. We're healing you.' This would be no more than an extreme application of the political philosophy implicit in most modern communities. It has stolen on us unawares."[15] Both Ellul and Lewis have observed that, in Lewis's words, "The increasing complexity and precariousness of our economic life have forced Government to take over many spheres of activity once left to choice or chance. . . . . We are less their subjects than their wards, pupils, or domestic animals. There is nothing left of which we can say to them, 'Mind your own business.' Our whole lives are their business."[16]

C. S. Lewis and Jacques Ellul were similar to one another, with respect not only to their views of government, but also their understanding of how science and technology relate to government. Lewis wrote, ". . . I dread government in the name of science. That is how tyrannies come in. In

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[14]Ellul, *False Presence of the Kingdom*, 16-17.
[15]C. S. Lewis, "Willing Slaves of the Welfare State: Is Progress Possible?" *The Observer*, July 20. 1958.
[16]C. S. Lewis, "Willing Slaves of the Welfare State: Is Progress Possible?" *The Observer*, July 20. 1958.

every age the men who want us under their thumb, if they have any sense, will put forward the particular pretension which the hopes and fears of that age render most potent."

According to both Lewis and Ellul, the increasing controlling influence of science and its use as such by government had a particular pedigree in the history of Western civilization. In *The Abolition of Man*, Lewis wrote: "I have described as a 'magician's bargain' that process whereby man surrenders object after object, and finally himself, to Nature in return for power. . . . The real story of the birth of Science is misunderstood. . . . The sixteenth and seventeenth centuries are the high noon of magic. The serious magical 87ndeavor and the serious scientific 87ndeavor are twins. . . . They were born of the same impulse. . . . There is something which unites magic and applied science while separating both from the 'wisdom' of earlier ages. . . . For magic and applied science alike the problem is how to subdue reality to the wishes of men: the solution is a technique."[17]

Ellul wrote something very similar in his work, *The Technological Society*: "Magic developed along with other techniques as an expression of man's will to obtain certain results of a spiritual order. . . . In the spiritual realm, magic displays all the characteristics of a technique. It is a mediator between man and 'the higher powers.' . . . It affirms human power in that it seeks to subordinate the gods to men, just as technique serves to cause nature to obey."[18]

"Technique," in this context, is a mentality which values efficiency, involving the extension of machine logic into social and personal spheres. Working with self-consciously Christian assumptions, both Lewis and Ellul feared the possibility that, through science and technology, governments might infringe upon the rights of individuals and groups, and as we have seen, both expressed concerns regarding science and technology and their use for governmental overreach and control of citizens.

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[17]C. S. Lewis, *The Abolition of Man* (New York.: Macmillan Publishing Company, 1947/1955), 87-88.
[18]Jacques Ellul, *The Technological Society* (New York.: Vintage Books, a Division of Random House, 1964), 24.

Introduction to Quantum Metamechanics (QMM) by Christopher Langan

Christopher Michael Langan (Mega Foundation)

Abstract: Solutions for problems arising at the limits of science and philosophy require ontological grounding. Quantum Mechanics (QM) is increasingly called upon as a source of insight regarding such problems, but is not itself well-understood. The fact that QM has many conflicting interpretations for which ontological status is claimed demands a "post-quantum" theory which clarifies its meaning, settles the differences among its interpretations, and facilitates the analysis and solution of otherwise intractable problems. Herein described as *Quantum Metamechanics* (QMM), this theory is a "meta-interpretative" mapping of QM and its various interpretations into a supertautological description of reality, the CTMU Metaformal System. By incorporating the CTMU, a true ontic identity supporting the self-identification and self-existence of reality, QMM provides QM with a valid ontology in terms of which its various interpretations can be evaluated and synergized.

KEYWORDS: CTMU, Cognitive-Theoretic Model of the Universe, Quantum Mechanics, Quantum Metamechanics, QM, QMM, Ontology, Quantum Ontology, Metaformalization, Formal Quantization, Metacausation, Retrocausation, Interpretation of Quantum Mechanics

I. Introduction

As never before, scientists and philosophers are trying to solve "big questions" having to do with such imponderable concerns as the nature and extent of reality, the origin and nature of life, the nature of mind and consciousness, the origin of the cosmos, the nature of space, time, and causality, the essence of human existence and spirituality, so-called paranormal phenomena, and other matters seemingly resistant to mechanical, material, or physical explanation. Accordingly, science and philosophy have been gravitating toward the broad and highly successful theory of quantum mechanics (QM) as a source of insight. But despite its great theoretical and methodological utility, QM is as much a mystery as the questions themselves, and that of which the meaning is unclear is not itself a credible source of meaning. This has led to the search for a "post-QM" theory that properly explains QM itself and is thus better equipped to deal with metaphysical issues.

The purpose at hand is to identify the requirements of such a post-QM theory and then describe it in logical terms. Because this theory is necessarily a metatheory (or theoretical metalanguage) of QM, it is called **Quantum Metamechanics** or **QMM**. Its purpose is to map QM, along with any valid hypothetical correlates designed to obviate or accommodate its apparently problematical features, into the CTMU Metaformal System (Langan, 2018), a comprehensive high-level formulation of the structure of reality independent of QM itself, and then to explicate their relationship and thereby synergistically relate the microscopic and macroscopic scales of reality to each other. Because the Metaformal System is a supertautological (intrinsically valid) reflexive model of reality predicated on its manifest intelligibility, QMM can be described as a reflexive application of model theory which reliably locates QM within the theater of being.

Opinions to the contrary notwithstanding, QM itself is not an ontology. QM is a formal system standing apart from its universe, a mathematical apparatus incorporating such ingredients as linear algebra, Fourier analysis, and probability theory. Given the existence of certain measurements, QM merely yields statistical predictions of their outcomes. QM does not include definitions or attributions of being, existence, or reality. Assertions relating these concepts to QM reside elsewhere, usually in a more or less speculative interpretation of QM in an imperfect description of an incomplete set of observations labeled “physical reality”.

That ontological status has nevertheless been claimed for various interpretations of QM – that they are called “quantum ontologies” – reflects a widespread misunderstanding of the word “ontology”. In the minds of most scientists and philosophers, ontology consists of “claims about existence”, e.g., the kinds of object, relation, operation, and process that exist in the world, and related epistemological claims about the nature and limits of knowledge, e.g., what kinds of knowledge are possible under what conditions. But insofar as anyone can make any claim at all about anything one likes, this is a trivialization. If existence can be meaningfully attributed to anything at all, then a valid ontological language must exist, and it must consist of actual knowledge rather than mere “claims”.

Concisely, an *ontology* is a theoretical language that accounts for the nature and content of being (reality, existence) and logically supports its attribution on all scales and all levels of discourse. This carries certain requirements that QM cannot fulfill. *Being* is not an ordinary attribute, but the highest attribute of all; no lesser attribute can be meaningfully attributed to anything of which some kind or level of being, even if “purely conceptual”, is not already a property. Moreover, just as QM suggests, ontology is intimately related to epistemology, which deals with the nature and limits of knowledge. Because something must *exist* in order to be known or identified, while that which exists must be *identifiable* as a value or instance of the attribute “existence”, identifiability and existence must coincide.

While QM is considered by some to define the limits of physical measurement and thus of empirical identification, there are other things to be identified in the name of science – ideas, concepts, sensations, feelings, judgments, intentions, intuitions, and theories like QM itself, for example. It is simply not the case that abstract and subjective forms of existence and identity can be wholly supervened on “physical” objects and processes.

II. Overview of QM

Informally, a *quantum* of X is the smallest particle or indivisible instance of X, while *mechanics* is the branch of physics dealing with the motion of bodies and the energy and forces producing motion, including statics, dynamics, and kinematics. It follows that *quantum mechanics* is the study of how energy and forces relate to the motion of particles. But this is a bit deceptive, as the elementary particles studied in physics do not actually “move” in the usual sense of moving bodies.

In fact, the elementary particles of physics are observed only when they are measured, and what they do between measurements is never witnessed. To call it “motion” in the usual sense is an assumption. Moreover, to measure them is to cause them to change state, which means that they are seen only in conjunction with state-transition events. Experimental data suggest that between these events, they become waves. This is the easiest conclusion to draw from (e.g.) the famous double-slit experiment, in which sending particles through a pair of slits in a partition produces a distinctly wavelike interference pattern on a screen.

The interference pattern produced in the double-slit experiment is considered strange because it occurs even when the particles are sent through the slits at widely spaced intervals. Thus, their respective “waves” cannot be interfering with each other in real time. The waves can only be interfering with each other in association with *each individual particle*, implying that each particle is somehow equivalent to coherent set of “probability waves” that superpose on and interfere with each other in association with it, influencing the motion of the particle if not actually guiding it to its point of impact. In other words, between the emission event and its impact on the screen, each particle behaves like a coherent superposition of waveforms. Accordingly, each particle or physical system capable of quantum coherence is associated with a "quantum wave function".

Why a wave, and why a function? First, we have the wavelike behavior of light, extended to particles of matter by de Broglie. Secondly, that only one of multiple possibilities is actualized as the outcome for a given quantum event requires a many-to-one function to select the one from the many (or, given the fact that quantum experiments can be formulated as yes-no questions, to select one of two possibilities). Thirdly, that we have an apparent superposition of possibilities means that we require something that obeys the superposition principle (or property), which says that for a linear function or system, the net output is the sum of the individual inputs. (That is, if input b produces output x and input c produces output y, then input b+c produces output x+y.) Although the world contains many nonlinear phenomena, its linear aspects are what make possible a reasonable notion of causality whereby cause and effect are "in proportion".

Linear systems include both wave media and vector spaces; a superposition of waves is just the sum of their amplitudes at each point, while a superposition of vectors is just a vector sum. Because (by Fourier's Theorem) any wave, classical or quantum, can be expressed as a unique sum of sine waves in superposition, and because the Hilbert space of quantum states is both a vector space and an inner product space in which vectors can be superposed, added together, multiplied by scalars, and multiplied by each other, the superposition of two possible states is again a state of the system. That is, if $|\psi_1\rangle$ and $|\psi_2\rangle$ are possible states of a system, then so is $|\psi\rangle = a_1|\psi_1\rangle + a_2|\psi_2\rangle$.

This can be interpreted to mean that the system is "in both states at once". When the system is in a superposition of possible states, its wave function is said to be *coherent*. On the other hand, when it is measured, its possible states suddenly decohere and its wave function "collapses", or at least *appears* to have collapsed, into a single definite state.

In classical mechanics, the state of a physical system consists of values for all of its observable attributes or "observables". In contrast, a quantum state consists of values for a "complete set of commuting observables" that can be measured one after another without disturbing the rest.

The commutativity restriction owes to the fact that some observables are “conjugate” and therefore do not commute; measuring one can disrupt the other, putting it into a superposition of different possibilities and thus destroying the information available on it.

This relationship between conjugate observables defines an epistemological limit of QM. It is called the **Heisenberg Uncertainty Principle** (Messiah, 1999) and is written

$$\Delta x \, \Delta p \geq \hbar/2$$

where the symbol Δ denotes the “spread” or loss of information on the associated variable. Here, the noncommuting observables are position x and momentum p. The principle could also be expressed, for example, in terms of energy E and time t as

$$\Delta E \, \Delta t \geq \hbar/2$$

In the view of Bohr, Heisenberg, and others, the epistemological uncertainty principle has ontological bearing. According to Bohr’s Quantum Postulate, reality is naturally quantized, or discretely partitioned into measurable stationary states with nothing intelligible inside or between them, and according to his Correspondence Principle, quantum mechanics must reproduce classical physics in the macroscopic limit of large quantum numbers. In other words, QM must “scale” from discrete microscopic to continuous macroscopic physics (Bohr, 1928).

Insofar as the focus of QM is the limiting scale of physical measurement on which classical mechanics breaks down, Bohr and Heisenberg saw QM as a terminal theory of reality of which classical physics is just the macroscopic limit. Yet at the same time, Bohr insisted that only the classical conceptual language of the macroscopic, fully observable physical domain be used to express knowledge of quantum objects and processes, and that all scientific investigation must rest on a concrete foundation.

“[An] unambiguous communication of physical evidence demands that the experimental arrangement as well as the recording of the observations be expressed in common language, suitably refined by the vocabulary of classical physics. […] In all actual experimentation this demand is fulfilled by using as measuring instruments bodies like diaphragms, lenses and photographic plates so large and heavy that, notwithstanding the decisive role of the quantum of action for the stability and properties of such bodies, all quantum effects can be disregarded in the account of their position and motion.” (Bohr, 1962, p. 91)

In short, QM not only characterizes the microscopic limits of measurement, but also marks the limits of reality. In a way reminiscent of Wittgenstein’s observation that “the limits of my language are the limits of my world,” the descriptive limits of QM also seem to limit reality itself, compelling the use of classical language to describe it. This, basically, is the theme of the Copenhagen Interpretation.

The Copenhagen Interpretation as “Quantum Ontology”

The Copenhagen interpretation originated in the mid-1920’s as a product of expert collaboration involving Niels Bohr, Werner Heisenberg, and others (Herbert, 1985). Following close on the heels of QM itself, it is considered the original and paradigmatic interpretation of quantum mechanics. In keeping with the uncertainty principle, it asserts that physical systems lack definite properties prior to being measured, and that quantum mechanics can only predict the probability distribution of the possible results of a measurement. In effect, the measurement “collapses” the probability distribution to just one possible value, which did not previously exist but has come into existence due to the measurement (we will later refer to this property as “generativity”). In short, the real, physical state of the measured entity relies on measurement itself, which relies on those who do the measuring, and therefore cannot be separated from them. Because the probability distribution is described by a wave function, this is called the *reduction* or *collapse* of the wave function.

Because the Copenhagen interpretation asserts the *nonexistence* of physical properties, values, and states between measurement events, but asserts that they come into *existence* upon measurement, it has ontological bearing. Hence, it is widely considered the original “quantum ontology”, a phrase which requires explanation. Conventionally, quantum ontology does not address the ontological or existential status of QM itself. Rather, it takes QM for granted and addresses its ontological implications for physical reality and sometimes reality in general. In this context, *reality* is synonymous with *being* or *existence*; if something is *real*, then it *exists* and has *being*. But as for the meaning of these synonyms, they are regarded as either primitive (i.e., associated with direct physical observation) or defined; and where they are deemed needful of definition, they are defined on either QM and the rest of physics (as in the

Copenhagen Interpretation), or on the very interpretation of QM in question. In any case, it has become the height of fashion for anyone with an "interpretation of quantum mechanics" to declare it a self-contained "quantum ontology".

Unfortunately for such declarations, one cannot properly interpret a theory without having something definite to interpret, and something definite in which to interpret it; and one cannot have an ontology which fails to incorporate a metalanguage which is so defined as to support attributions of *reality, being,* and *existence* on all scales, from the quantum scale up to the entire cosmos. Quantum mechanics only partially meets only the first of these criteria, and makes no pretense of meeting the second. Aside from statements dealing specifically with physical measurements, most of it resists interpretation in concrete reality, and those interpretations of QM which receive the most attention do nothing to improve the situation. In fact, most of them are primarily concerned with getting around what many consider the biggest problem in quantum theory, the collapse of the wave function, and are thus reactions against Copenhagen.

III. The Measurement (Collapse) Problem of QM

The reduction of the wave function can be described as follows: the time evolution of a quantum state or wave function $|\psi\rangle$ is given by the nonrelativistic Schrödinger wave equation

$$I \hbar \, \partial/\partial t \, |\psi(t)\rangle = H(t) \, |\psi(t)\rangle,$$

where $I = \sqrt{-1}$, $\hbar$ is Planck's reduced constant $h/2\pi$, t is the time parameter with respect to which the wave function $|\psi(t)\rangle$ is differentiated, and H is the Hamiltonian operator representing the total energy of the system.

The Schrödinger Equation is linear in several important respects. For example, it can be simplified to unitary transformations which preserve inner products, and it has linear operators acting on a linear state vector (or wave function) in such a way that linearity holds among its solutions: if ψ_1 and ψ_2 are solutions, then so is $\psi = a_1\psi_1 + a_2\psi_2$. This restricts the entire description to linear spaces and linear geometry, excluding anything that cannot be expressed in a linear continuum. From the instant that $|\psi\rangle$ arises as a solution of the Schrödinger equation to its transformation into a new state, its dynamic is assumed (but not observed) to be both linear and wavelike.

Adapting the notion of linear causation to the quantum scale, QM drops the classical assumptions of determinacy and locality and makes the best of quantum uncertainty by replacing the notion of causal determinacy with inductive probability. Its success in describing microscopic reality thus comes at the cost of statistical de-resolution, a trade-off which reflects its inadequacy for describing the deep structure of reality. The best that QM can provide under these circumstances is a statistical approximation of acausal "wave function collapse".

Wave function collapse occurs as follows. At the point of measurement, $|\psi\rangle$ becomes a superposition of eigenstates of the quantity being measured and immediately collapses: $A|\psi\rangle \rightarrow a_n|\psi_n\rangle$. Mathematically, $|\psi\rangle$ has "expanded in" (been filtered or partitioned into) the eigenbasis of the operator (A) associated with the measured quantity or "observable", and then for all practical purposes instantaneously transformed from a superposition of many possible states into a single eigenstate.

The essence of the measurement problem is that the projection postulate and its measurement-induced reduction (collapse) of the wave function conflicts with Schrödinger's equation, which prescribes the continuous deterministic unitary evolution of states rather than sudden, seemingly inexplicable punctuations. As mandated by the uncertainty principle, QM is probabilistic; between measurements, physical systems "exist" not as definite, directly observable states and state-transition events, but as undetectable and therefore unphysical superpositions of *possible* states.

These probabilistic superpositions, which are not even described by classical probability theory but require a "quantum" theory of probability all their own, must alternate with the definite outcomes of physical measurement events themselves. This implies that vast, spatially extended potentials coinciding with distant points of space, possible future states of a physical system which have not yet been actualized, are carried outward from quantum events at the speed of light only to be instantaneously confined to more or less precise locations.

This problem, which is connected to complementarity and wave-particle duality, is viewed as the central problem of QM. More than anything else, the measurement problem drives the "QM interpretation industry" of modern physics and philosophy, the successor of QM itself with respect to a considerable number of academic publications.

IV. The QM Interpretation Problem

QM began as a mathematical theory of physical measurement. Considered in isolation, it is a rather skeletal affair consisting primarily of linear algebra along with other kinds of mathematics related to it by inspiration and convenience. Like all mathematics, its formal expression is abstract and symbolic. It can appear stark and intimidating when considered apart from the many experimental contexts to which it is applied, but for mathematics this can hardly be considered damning. The real problem has to do with the fact that it is difficult to motivate in terms of the small-scale measurements it describes. Such measurements require QM precisely because more intuitive macroscopic descriptions fail to work.

This suggests a sartorial analogy. On the bare-bones algebraic mannequin of QM, layer upon layer of clothing has been draped and piled by designers who differ strongly in their opinions of what looks good on it. To put it mildly, their visions clash with even less appeal than the underlying skeleton, tending to cancel each other. Consequently, even after their disorganized attempts to bury it under a mound of conceptual raiment, its bones poke through as starkly as ever, dangling and jutting like the girders and cranes of an unfinished skyscraper. Thus, while grudgingly praised for its spectacular empirical success, it continues to be roundly panned for its abominable aesthetics, prompting various efforts to “dress it up” in new interpretations that on close examination turn out to be equally counterintuitive and unappealing.

An interpretation of a theory is a “structure-preserving” correspondence or mapping between a theory regarded as the formal domain of the mapping, and a range or codomain consisting of a universe in which the theory is instantiated (i.e., in which it has instances consisting of specific objects, relationships, and processes that conform to it). The oxymoronic concept of “literal interpretation” notwithstanding, interpretation is a necessary stage in the recognition of any theory. No theory can be understood in terms of uninterpreted symbols, and the meanings of its constituents are dependent on the interpretative context in which it is defined. That such context must be provided in order to determine the “intrinsic structure” of a theory suggests that even when it is assumed that a given interpretative mapping will not change the theory to which it is applied, there is in fact a potential for theoretical structure to be changed.

The intrinsic structure of a theory can be at least partially clarified by *formalization*. A theory can be formalized by interpreting it in one or more well-defined structures including the language in which it is expressed along with any axioms and rules of inference supporting its descriptive or normative functionality. But while this definitely helps limit ambiguity, these formal structures – languages and axiomatic systems – may contain ambiguities of their own. Try as we might to nail everything down, theories do not always uniquely determine their universes, models, or interpretations, and universes do not always uniquely instantiate theories. (For purposes of orientation, the logical principles usually associated with interpretative variability include the *Löwenheim-Skolem theorem* and the *Duhem-Quine thesis*.)

Technically, interpretations of QM are correspondence mappings of which the formal domain is always the theory of QM, and the universe is always empirical or "physical" reality including the set of microscopic measurement events. As for the domain, QM is a theory that comes with principles and postulates that make it a formal system. However, like any formal system, it does not come packaged with a model, i.e., a valid correspondence between itself and any particular universe or set of instances. It merely refers generically to empirical reality, providing a general prescription for the execution and analysis of measurements of submicroscopic phenomena. Nevertheless, QM may be considered to intersect with empirical reality in precisely the measurement outcomes that it correctly (statistically) predicts.

The problem is that this intersection is only partial. Although the degree of correspondence between QM and the measurement events in which it is interpreted is often impressive, it is merely probabilistic; QM underdetermines its content and thus exhibits causal deficits. In particular, QM does not include the level of causation that predicts the occurrence of measurement events or determines their specific outcomes. Even worse, most of the complex mathematical apparatus of QM has nowhere to go; the empirical universe contains nothing that obviously corresponds to it and thus has "nowhere to put it". There appears to be nothing in empirical (observable) reality capable of supporting such things as probability waves and the equations that govern them.

In keeping with the scientific method, a scientific theory and its empirical universe absorb each other through their structural correspondence in an inevitable process of mutual contextualization and accommodation. Whereas a formal system isolates theory from universe, a theory cannot be isolated from any universe to which it is actually applied. This is especially true for any scientific theory intended to describe the empirical universe as it is progressively revealed to the human mind and senses. In establishing a “structure-preserving” correspondence between theory and universe, we are forced to deal with a joint structure that evolves as they feed back on each other as prescribed by the scientific method. For QM, this joint structure is limited to bare measurement events and their QM-predicted observable consequences; the rest of QM is either excluded, or empirical reality is interpretatively embellished with extra ingredients designed to accommodate it.

In other words, the description of the empirical universe changes as new observations are made, and the scientific method requires constant feedback between theory and universe in order to ensure a good descriptive / instantial fit. However, explanatory gaps and creative slack in this process of mutual accommodation can create holes through which one could drive a truck, so to speak. When this occurs, physicists are often completely unconstrained in making up new, empirically untestable “physical” structures and processes to which problematical QM ingredients can be mapped, and/or adding to or subtracting ingredients to/from QM in order to fit it to their preferred descriptions of the universe. (E.g., von Neumann implicitly adds to reality the physically undefined concepts of mind and consciousness in order to explain wave function collapse, Everett adds an unobservable cosmic wave function that generates countless totally unobservable alternate universes, de Broglie and Bohm add unobservable “pilot waves” that guide particles along linear localistic trajectories through nonlocal pilot fields, and so on.)

While QM is formulated in hard mathematical language, the empirical universe it describes is known strictly by direct observation and logical deduction. The only sure way to characterize the physical universe is by the minimal description of physical observations with no inferences but those obtained by plugging bare observational data into deductive logic. With respect to QM, this leads to a problem: there is no sure way to describe the physical universe that can fully accommodate QM, which contains ingredients of which the empirical universe appears to contain no observable instances. If there *were* such a description, then QM could be at least partially coupled with it in an appropriate language, pinning down both ends of the model-theoretic correspondence and thereby restricting the interpretation of QM.

V. Formal Quantization

Physics involves an operation called “quantization” which involves the division of physical properties and substances into their smallest possible discrete units or instances. For example, chemical compounds can be quantized in terms of molecules, molecules can be quantized as atoms, atoms can be quantized as protons, neutrons, and electrons, and the frequency of a standing wave like an atomic orbital can be quantized in terms of its ability to accommodate only a whole number of wavelengths without self-destructive interference. In quantum mechanics, the property which is quantized is called “action”, defined as energy multiplied by time (making it both energetic and timelike) and roughly synonymous with “physical change”. Many other physical properties can be quantized in terms of it.

However, quantization applies just as well to other kinds of property, including those which are purely mathematical. As physics is expressed in terms of various mathematical formalisms, it relies on the quantization of mathematical concepts well before it arrives at quantum mechanics. Of course, formal quantization is a well-recognized mathematical necessity. Sets are quantized as elements, topological spaces are quantized as points, geometry is quantized as lines, which are quantized as points and units of length, and angles, which are quantized as radians or degrees. More generally, any kind of formal system is quantized as symbols representing objects, relationships, functions, and operations. These symbolic “quanta” characterize the signature of the system; every symbol in the system must conform to one of these descriptors (including typographical symbols including empty spaces), and to each a degree of coherence is assigned.

The coherence of a symbol is what enables it to have a definite meaning and to be treated as a single unified entity. The coherence property is crucial; it means that anything possessing it can be treated as a unitary entity which behaves or transforms in a unified and regular way under certain mathematical or physical operations. Defined in terms of the coherence property, quantization means “division of a coherent identity into coherent subidentities which act as unitary entities and thus behave coherently.” (This holds true in QM, where the coherence of a quantum wave function means that all of the possible states of the associated physical system cohere in mutual superposition and evolve in phase with each other.)

Unfortunately, there are problems with mathematical quantization, and they carry over into physics. This is easy to see in the case of a classical manifold, basically a space consisting of zero-dimensional (0D) points (real numbers, elements of the real continuum R^n) and equipped with a metric that is "locally Euclidean", permitting a reasonable in-frame notion of distance and locality. Immediately we detect a paradox: "of zero extent in a given space" means "nonexistent in that space" – existence in a space means taking up space in it – and we cannot assert the *existence* of a space consisting of *nonexistent* points that take up no space at all. Even if we could, there would be yet another problem associated with continuity, the *adjacency paradox*. An infinitesimal line element or increment of linear motion must relocate a point-object from one point to an adjacent point. But where points are zero-dimensional as continuity demands, adjacency or "being in mutual contact" effectively identifies them. Adjacent points simply merge, and no relocation can occur. Linear motion is out of the question.

It follows that continuous motion requires finite termination or bounding of the interval in order to scale and sum infinitesimal increments, produce a definite integral, and assign a length to the interval. But this still leaves nonzero (albeit sub-finite) separations between each pair of successive points along a path or physical trajectory, and an object must "jump out of" the manifold or space in order to get from one point to the next. Motion then becomes a series of infinitesimal "quantum jumps" through hyperspace. This, of course, is not what mathematicians and physicists typically have in mind when they talk about "the continuous (differentiable, smooth) motion of objects or waves through the continuum". (We ignore for now the various workarounds that have been proposed for these problems, at least one of which – usually the Cauchy-Weierstrass epsilon-delta formalism based on infinite converging sequences – is generally invoked in introductory calculus courses in order to deflect the "problem / paradox of infinitesimals", which is never satisfactorily resolved with respect to the existence or nonexistence of 0D points and infinitesimal intervals between them.)

Naturally, this problem, being deeply rooted in the foundations of mathematics, was bound to emerge in the course of formulating and following mathematical procedures in physical calculations. Specifically, it was bound to emerge in connection with submicroscopic measurement procedures.

VI. QMM Metaformalization

Quantum Metamechanics or **QMM** is a "meta-mapping" that maps entire QM interpretations into the absolute structure of reality, and depending on their logical consistency, embeds them there. Only thus can the most valuable features of various QM interpretations be merged in a single coherent overall description of reality.

The formalization of a theory T amounts to the addition of axioms and rules of inference to a formal language L accommodating the expression and development of T, thus embedding T in L. Where the syntax and grammar of L amount to the "axioms and rules of inference" of L, the axioms and rules of T amount to an extension of the syntax and grammar of L, making T a special-purpose "sublanguage" of L. Where T = QMM and L = the supertautological Metaformal System (Langan 2018), this process amounts to "QMM Metaformalization". Because the intrinsic-language structure of the Metaformal System suffices to determine QMM, additional (QMM) axioms and rules of inference are unnecessary.

QMM metaformalization requires metaformalization of the generic QM-interpretative (QMI) mapping QMI:QM←→U, the domain and codomain of which are QM and empirical reality respectively. The problem with the generic QMI mapping is that thanks to the fertile imaginations of various scientists and philosophers, empirical reality has "overrun its buffers" in various conflicting ways and thus lacks a coherent formulation of its own, with the result that interpreters of QM are basically willing their preferred versions of reality into hypothetical existence as they please and calling it "ontological". No QM interpretation incorporating what may be an incoherent description of empirical reality can be judged trustworthy.

In contrast, QMM maps QM into empirical reality as represented by the CTMU. Thus, QMM is not just another interpretation of QM, but a metaformal extension of QM which specifies the absolute structure of its codomain and is itself embedded therein. Whereas ordinary QM interpretations speculatively modify the "reality" concept in order to solve or circumvent the measurement problem, QMM interprets QM in the supertautological Metaformal System.

Having itself been metaformalized, QMM can thus be described as the "metaformalization" of QM. This amounts to a true and inevitable extension of the QM formalism to incorporate a true metaformal ontology. It is in this extended structure that ordinary interpretations of QM, including their "ontological" claims, must themselves be interpreted.

The codomain and domain of QMM mapping may be described as follows.

Specifying the QMM Domain

Just as for ordinary QM interpretations, the formal domain of the higher-level QMM mapping includes QM. However, this requires a qualification: the codomain now consists of the CTMU supertautology, a metaformal ontic identity that equates existence to its own self-identification and thus couples ontology and epistemology. This affords a crucial advantage: being logically induced from the intelligibility of reality, the supertautology requires no additional proof and immediately qualifies the mapping as a true "quantum ontology". But it also comes with what may seem a disadvantage: the codomain can no longer unconditionally accommodate mere speculations, instead holding them in the domain along with QM. The domain now contains the entire QMI mapping, no extra features of which can accompany QM into the codomain unless they are consistent with the embedment of QM itself in the CTMU supertautology.

As for the usual formalism of QM, it can be described in terms of a variable axiomatic structure which is to some extent a matter of preference. But while the core concepts of QM can be differently organized, certain mathematical ingredients are indispensable. This allows us to describe the formal structure of QM with a set of postulates similar to the following:

1. The state (vector) of a quantum mechanical system, including all the information that can be known about it, is represented mathematically by a normalized ket $|\psi\rangle$. At each instant, this ket represents the state of a physical system in the space of states, a vector space called *Hilbert space*. Associated with the system is a *wave function* which, unlike a particle, extends throughout space and consists of possibilities in mutual superposition.

2. A physical observable is represented mathematically by an operator A that acts on kets. When operating on a wavefunction with a definite value an of that observable, it yields that value times the wavefunction: $A|\psi\rangle = a_n|\psi\rangle$

3. The only possible result of a measurement of an observable (physical) property is one of the eigenvalues a_n of the corresponding operator A.

4. The probability of obtaining the eigenvalue a_n in a measurement of the observable A on the system in the state $|\psi\rangle$ is $\text{Prob}(a_n) = |\langle a_n|\psi\rangle|^2$, where $|a_n\rangle$ is the normalized eigenvector of A corresponding to the eigenvalue a_n.

5. After a measurement of A that yields the result (eigenvalue) a_n, the quantum system is in a new state that is the normalized projection of the original system ket onto the ket (or kets) corresponding to the result of the measurement: $|\psi'\rangle = P_n|\psi\rangle / \sqrt{(\langle\psi|P_n|\psi\rangle)}$. [This is a particular formulation of the *Projection Postulate*, which is central to the measurement problem.]

6. The time evolution of a quantum system is determined by the Hamiltonian or total energy operator H(t) through the time-dependent Schrödinger equation $I \hbar \, \partial/\partial t \, |\psi(t)\rangle = H(t) \, |\psi(t)\rangle$.

Note that the mathematical definitions and formulae in these postulates are formal and “syntactic” in character, conforming to generic and often mathematical rules which exist in the cognitive-perceptual syntax of observers … the accepting syntax through which they recognize and absorb cognitive and observational input, supporting and constraining cognition and perception. As these rules are being projected on that part of physical reality consisting of submicroscopic events which would otherwise be unidentifiable as physical phenomena, they amount to features of the physical medium itself. Moreover, because physical reality exists on the limiting submicroscopic scale and all coarser scales, they are being ascribed to physical reality, and where physical reality is an aspect of reality at large, to reality as a whole.

Standard interpretations of QM are targeted on the same reality as that to which QM itself applies. Hence, their “extra” ingredients map to the same overall structure as does QM itself.

Specifying the QMM Codomain

Reality, the target of the partial interpretative mapping of QM which various interpretations supposedly “complete”, has always been hard to define. From academically cloistered quasi-robotic gray men pushing symbols from equation to equation on dusty blackboards to Buddhist monks chanting together in their saffron robes, the vast majority who have tried have come up short. Reality displays immense complexity, and one tends to either become lost in the tangle or throw up one’s hands in surrender. As much insight as QM brings to the reality-theoretic table, it is also very strongly affected by this problem. One cannot establish the true correspondence of QM with reality when, having used calculus and linear algebra and Fourier analysis to put the source of the mapping in the crosshairs, one still cannot positively identify the target.

Before QM can be used in the solution of metaphysical problems, it must be integrated with reality on the highest, most general, most inarguable level of structure and dynamics. For this to happen, reality must first be conclusively identified on the required level of description. Popular ignorance notwithstanding, this mission has been accomplished; reality has been succinctly described as a primal self-identification operator which reflexively identifies itself and thereby attributes existence to itself, functioning “trialically” as an object, a self-relationship, and a self-operation. In order to do this, the operator – herein denoted by the acronym G.O.D. or “Global Operator-Descriptor” – uses the most generic level of its own self-attributed being as ontic potential, generatively actualizing itself from that potential in the form required for existential self-identification and scientific intelligibility. Specifically, it takes the form of a supertautological intrinsic language which has been described in these Proceedings as the **Metaformal System**.

The Metaformal System $M = \{\Sigma(N,T), \Gamma\mu, S_\Sigma\}$ is a supertautological *intrinsic language* characterized by complete self-containment. That is, its self-dual signature Σ consists of a nonterminal metaphysical domain N and a physically emergent terminal domain T, and its generative grammar $\Gamma\mu$ controls the N|T relationship, producing the timelike strings (histories, paths, trajectories) S_Σ of T from the nonterminals of N. As an ontic identity language, M factors into dual *semilanguages* Ls and Lo which comprise its intensional and extensional aspects respectively. Although the definition of M strongly resembles that of an ordinary formal language with a signature, a grammar, and a set of linear “strings”, it is a trialic metaformal language which evolves by modeling itself in its own intrinsic universe.

The fundamental objects of M are active signs called *telors* (telic identification operators), secondary quanta existing in N along with the primary quantum or G.O.D. representing the entire system, and *syntactors* (syntactic identification operators), including tertiary syntactors comprising the subatomic particles of the physical domain T, which depend on more complex but nonetheless coherent self-modeling telors for their regenerative existence. Its μ-morphic grammar $\Gamma\mu$ is a self-identification operation which produces $S_\Sigma \supset T$, the set of terminal strings of M – the external states and linear trajectories of tertiary syntactors in the terminal domain T comprising the “surface structure” of M – by generating them in the pregeometric domain of N and projecting them onto physical timelines. Thus, M evolves by generatively identifying itself.

Conveniently enough for present purposes, the supertautology M is *self-quantizing*. It is an ontic identity – a coherent, intension | extension coupling formulated with respect to the attribution of being and identity – which naturally partitions and "multiplexes" itself by its intrinsic μ-morphic grammar Γμ into coherent subidentities (active signs) that mirror its essential structure and can thus function coherently as its generative operators and/or physical content. Its self-quantization is both syntactic, applying to the formal level of being that controls identification, grammar, and orthography or well-formedness in T, and extensional or "semantic" (substantive, physical), forming meaningful configurations consistent with not just the syntax of intelligibility, i.e., the self-distributed rules of G.O.D. self-identification, but with the state of the external world. As a self-defining entity, the ontic identity must abut its logical complement *in situ*, permitting it to distinguish self from nonself.

The metaformal trialic self-quantization of the G.O.D. devolves to an *identity system* consisting of states coinciding with self-identification events that distinguish between self and nonself. The system generates at least three levels of identity: the primary or global level (the G.O.D.), the tertiary level (the level of ultimate and near-ultimate constituents of matter as already partially addressed by QM), and an intermediate level resolving the causal deficits of the primary and tertiary levels. This is the secondary mesoscopic level of identity, the classical scale occupied by various kinds and levels of secondary telor including human beings. Thus, just as the G.O.D. is the primary metaformal quantum of reality and elementary particles are tertiary quanta, human beings are "secondary quanta" with a combination of coherence and complexity that allows them to freely and meaningfully "self-model", configuring reality by configuring themselves. In other words, in the Metaformal System, life and consciousness are specifically quantized as innately coherent secondary telors whose coherent existence surpasses their physical emergence.

Like tertiary id-quanta – the submicroscopic, physically irreducible identities whose state transitions are quantized as action – secondary quanta are coherent identities mirroring the structure of the G.O.D. But unlike tertiary quanta, which are detectably coordinated by nothing but localistic fundamental forces and are otherwise seemingly probabilistic, they have sufficient complexity and nonlocal integrity to generatively "self-model" on behalf of the larger reality they populate. Just as envisioned by theorists like von Neumann, Wheeler, and Stapp, the self-realizing "conscious minds" of secondary quanta play a crucial role in filling QM causal deficits. They are among the key missing ingredients of standard quantum mechanics … primitive elements of the Metaformal System directly and indirectly responsible for the coordination and collapse of quantum wave functions, and thus for completing physical identification processes that cannot be completed by QM alone.

This being understood, QMM maps QM directly into the structure and dynamics of the ontic identity in a most unequivocal way.

The QM ←→ Reality Correspondence

As a trialic intrinsic language, the CTMU Metaformal System M combines *language, universe,* and *model* to create a perfectly self-contained metaphysical identity. The intensional aspect of M is a self-configuring self-processing language, and the extensional aspect couples to this language as a pointwise distribution of its syntax which provides the language with instances. This intrinsic language is self-similar in the sense that it is generated within a formal identity to which every part of it is mapped as content; its initial form, or grammatical "start symbol" – herein discussed at various levels of resolution as the ontic identity, the G.O.D., and the Metaformal System – everywhere describes it on all scales. In this system, time, causation, and the spatial expansion of the cosmos as a function of time flow in both directions – inward and outward, forward and backward – in a dual formulation of causality characterizing a new conceptualization of nature embodied in a new kind of medium or "manifold".

The CTMU conspansive manifold, conceived as a joint medium for QM and General Relativity, differs from a classical manifold in important respects, several of which are geometrically transparent.

1. Whereas a classical manifold consists of points which exist independently of their transient (moving) content– the points are static parameters rather than the states they contain – the points of a conspansive manifold are trialic, which means that they *are* content. The state of a particle (tertiary syntactor) in the manifold "inner expands" to become an open potential which engenders and contains the next state. (Insofar as these syntactors are coupled in mutual state-transition events, the conspansive manifold superficially resembles the conventional pseudo-Riemannian spacetime manifold which has "events" as its points.)

2. The conspansive manifold contains three topologically nested levels of "point" corresponding to three levels of active sign in the signature of M: the primary telor, secondary telors, and

tertiary syntactors, each instantiating its own level of metaformal quantization. Each kind of point has internal and external states. Points are rescalable by inner expansion and collapse.

3. Simplistically (nonrelativistically), the conspansive manifold can be "layered" in terms of the terminal and nonterminal subsignatures T and N of the signature Σ of M, consisting respectively of (a) current states, including those in T itself, which have occurred but have not yet been succeeded by newer states; and (b) past states deeper in N which have already been succeeded by newer states. The current layer includes the set of newly collapsed external states paired in mutual identification events that are occurring "right now / in the present" (ignoring for now the matter of simultaneity of events), and the set of "open" (still current) states which have not yet collapsed. The second, deeper layer consists of states which have already been replaced by newer states. Because states can never leave the overall manifold or primary point (as there is nowhere else for them to go), they remain in a state of *extended superposition* and are outwardly rescaled even after they have been replaced by new states and receded into the past, nesting and progressively interpenetrating as the manifold evolves (in contrast to the static extension of a "block world"). This "inner expansion" of the manifold, equating to the relative shrinkage of its content, is to be viewed in terms of rescaling morphisms rather than ordinary expansion and shrinkage. Thus, the entire manifold and its points are dynamically and in fact generatively coupled, changing in unison.

The generative dynamic of the conspansive manifold has primary and secondary stages. The primary stage consists of a self-dual n-ary (n-fold unary, n ≥ 2) operation, *conspansion*, with two alternating phases, *inner expansion* and *collapse*. Inner expansion *potentializes* the state transitions of the syntactors coupled in events – the points and events are brought into intersection by internal rescaling through the primary quantum (point) so that they "overlap" – while collapse re-actualizes the inner-expanded syntactors as compact objects in new interactions. Conspansion requires the progressive rescaling of points with respect to the manifold as a whole, leading to the apparent overall expansion of the manifold with respect to its content. The conspansive manifold thus evolves analogously to the physical cosmos, with intrinsic effects analogous to cosmic expansion, propagation of the wave function, and quantum wave function collapse.

The conspansive manifold evolves by way of generative information mappings that supersede standard physical causation occurring along timelike (or null) worldlines. Inner-expansive potentialization "opens" a tertiary identity or point of the manifold to N while collapsative actualization "closes" it in T; potentialization is null, while collapse is spacelike. Together, inner expansion and collapse comprise conspansive potentialization-actualization cycles which form self-dual information mappings, each of which initiates and actualizes a potential by restricting it to a specific outcome for a net gain of information. It is through these generative, metaphysical prereality-to-physical reality information mappings that the Metaformal System models and defines itself.

The evolution of the conspansive manifold is that of M itself. By way of conspansion, the generative grammar $\Gamma\mu$ of M produces the extensional (physical, geometric, topological) semilanguage Lo from its dual intensional semilanguage Ls. As QMM maps QM into the conspansive manifold, it thus induces an extension of QM into $\Gamma\mu$ and Ls. Driving $\Gamma\mu$ is a secondary stage of evolution of the conspansive manifold associated with primary and secondary quanta (the coherent higher-order points of the manifold) and called *telic recursion*. By telic recursion, adaptive exploratory feedback between Ls and Lo generates the terminal expressions of M, coupling and collapsing syntactors in interactive mutual identification events including the measurement events of QM.

QM is thus mapped to the open top layer of the conspansive manifold, where inner expansion is approximated by the symmetric timelike propagation of the wave function according to the time-dependent Schrödinger equation (bearing in mind that Ψ(x) and the Schrödinger equation must ultimately be formulated in terms of the point-structure and topological dynamic of the manifold), and conspansive collapse is thus analogous to wave function reduction (collapse, projection). The irreducible characterization of a QM measurement like $\langle\psi i|\psi\rangle$, in which a present (or prepared) state ψ "casts its shadow" on vectors representing possible next states, implies that collapse is just the conspansive rescaling of inner-expanded static potentials: $A|\psi\rangle \rightarrow a_i\,|\psi_i\rangle$. This reflects the topological dynamic of the conspansive manifold, in which both phases of conspansion regulate and transform its point-structure. Adding a metaphorical touch to the implicit anthropic coupling of observer and universe, one might observe that this causes the manifold to "breathe". The conspansive manifold thus mirrors quantum dynamics, rescaling, combining, and collapsing quantum wave functions along with its own points in a fully coordinated fashion.

Self-Modeling

Like M itself, the conspansive manifold evolves by “self-modeling”, i.e., by letting active Ls semantic potentials “inside the points”, their internal states, guide and coordinate wave function collapse to produce the physical content of Lo “outside the syntactors” as external states (this can be likened to a directed form of “decoherence” replacing the more familiar random kind). In terms of information: where the manifold is a pointwise distribution of M-syntax, collapse is a spacelike information mapping which achieves specificity by the semantic reduction of inner-expansive scope or extent. QM indeterminacy and probabilism allows this process the freedom required by its innate generativity.

In the conspansive manifold, the coordinated self-modeling of primary and secondary quanta flows “retrocausally” outward and pastward from the advanced semilanguage Ls into the retarded semilanguage Lo. The content of the flow is determined by the telic-recursive feedback of Ls, the dynamical semilanguage of M, and Lo, the “static” semilanguage of M which is already bound in the past and thus parameterizes Ls. But even as determinacy flows from future to past, the objects through which it flows are propelled along timelike gradients from past to future by retarded causation, a linearized approximation of the true metacausal dynamic. The true dynamic is not located in T at all; T is merely what the true dynamic produces as output, and reality can thus be described as a kind of “self-simulation”.

The linear semimodel of T – the collapsed “pixels” of the terminal “display space” to which classical physics is confined – affords access to only a localistic, linearized correlate of true causation, a mere projection of the real metacausal dynamics of M. It is on this surficially displayed causal simulation, the M-subsignature $T\subset\Sigma$, that true quantum reality is projected from the nonterminal domain $N\subset\Sigma$, thereby literally casting the shadows which seem to move across the walls of Plato’s dank and dimly lit cave.

Telesis

Strictly speaking, the “action” of $\Gamma\mu$ is not energetic, but telic and informational in nature; it effects the punctuated redistribution of energy as medium-content relationships are generatively redefined and emerge into the terminal domain T. Where energy is confined and conserved in T by definition, its longstanding function as the ultimate reduction of reality – a role it often fills in modern physics, and arguably in the history of physics as *vis viva* – requires some amount of adjustment, especially when moving away from T and deeper into the nonterminal domain. In the deep structure of M, the physical quantity *energy* must be reductively generalized to a protean "metasubstance", *110elesis*, which intrinsically determines its own properties and composition by unbinding and binding itself in conspansive potentialization-actualization cycles, and of which physical energy is just the conservative orthogonal restriction to T.

Telesis, a metaphysical generalization of both energy and volition, can be described as "self-actualizing self-potential" which generates medium-content relationships. According to Heisenberg, quantum objects are not so much hard bits matter as "probabilistic tendencies" or *potentiae* which "stand in the middle between the idea of an event and the actual event, a strange kind of physical reality just in the middle between possibility and reality" (Heisenberg, 1958). By process of elimination, Heisenberg could only have been talking about 110elesis.

In CTMU terms, Heisenberg's quantum potentiae coincide with tertiary syntactors (point-quanta) of the conspansive manifold that are inner expanding due to the generative self-action of 110elesis while interfacing between the nonterminal and terminal domains N and T. Thus, their actualization, amounting to quantum wave function collapse, is the mechanism of emergence of T from N, and of Lo from Ls.

Generativity

The Metaformal System M is an identification system consisting of an ontic identity with many subidentities which all identify each other, passively recognizing and actively transforming each other. By definition, generativity characterizes the evolution of any identification system not governed by timelike laws of causation relating a preexisting array or background medium to its content. Law, medium, and content must all be determined together in order for identification to occur, and because this amounts to a determination of causation itself, the process is by definition "metacausal" in nature.

In classical mechanics, a closure principle is assumed under which causation must be defined on the medium and content of nature, with outside factors excluded. For example, (1) a fixed law is induced – e.g., Newton's second law F=ma – which is intended to capture some aspect of the generic medium-content relationship, (2) a specific distribution of content in the medium is fed to this law as input (the "cause"), and (3) the law converts the causal input to output (the "effect"). Classical mechanics is thus ruled by "causal efficacy", in which cause determines effect by timelike laws which relate the medium of nature to its physical content. (Although we have deliberately chosen a very simple example in F=ma, it characterizes physical reasoning in general.)

The CTMU replaces the classical closure assumption with an ontic closure principle (ARC, or Analytic Reality Closure) under which the entire relationship between medium and output is self-selected from unlimited possibilities in the self-potentialization of the ontic identity and its subidentities. Rather than merely relating cause and effect (causal input and output states) using a timelike law within a fixed array, metacausal functions relate entire medium-content relationships within the conspansive manifold. Not only are cause and effect coupled in mutual dependency, but so is the law by which their mutual determination emerges. This mirrors the intrinsic dynamic of the generative grammar of M (and for that matter generative grammar in general), wherein any given expression and its grammatical abbreviation, its "start symbol", must be determined before the grammatical derivation of the expression can proceed.

In generative evolution, the exact relationship between a fixed array and its content is fundamentally indeterminate precisely because there is no fixed medium independent of its content, and paths cannot be defined until the dependency relationship has been generated. Inner expansion turns terminal states in T into a "typographical array" in which the next states can be written (Langan, 2017, 2018), unbinding and opening the quantum metric. For each new event, the entire relationship must be regenerated along with the "law" describing that relationship before a trajectory can be determined. Such a relationship is called a *telon*, the self-configuration of an active sign of Σ called a *telor* (self-configurable telic identification operator), i.e., a secondary and/or the primary quantum of QMM. Thus, primary and secondary telic quanta are the true source of quantum dynamics.

Conspansive Duality: Distributed and Linear Morphisms

The inner expansion-collapse cycles of the conspansive manifold are "distributed endomorphic" and "distributed ectomorphic". A distributed endomorphism can be approximately visualized as a sphere collapsing to an interior point, while a distributed ectomorphism can be approximately visualized as a point expanding into a sphere. (Such morphisms are defined as "hological", preserving essential structure on all scales.) On the other hand, temporal sequences of the successive collapsed states of objects – the strings of S_Σ – are "linear ectomorphic" in both directions, with objects traveling along linear paths or trajectories. This is called the *linear ectomorphic semimodel* of the conspansive manifold, associated with "display space" T.

Standard physics, including spacetime, is linear-ectomorphic. In a linear ectomorphism, an object leaves or enters a point of a manifold along a linear trajectory. (We have already seen that this leads directly to the adjacency paradox, forcing objects in motion to exit the manifold.) In the inner expansion-collapse cycles of the conspansive manifold, on the other hand, a telic point repeatedly "self-factorizes" into a self-nonself content-medium relationship under the guidance of one or more telons in such a way that an incremental linear displacement amounts to a conspansive cycle consisting of the inner-expansion of an initial state (the "medium") and collapse of its successor therein. Terminal content never leaves any point in its history, but merely *contracts within it*, projecting onto a timeline to define an ectomorphic interval.

Spacetime too is ectomorphic, consisting of points called "events" which are specified by four coordinates, three of space and one of time, that are separated by spacetime geodesics called *worldlines*. Spacetime can be overlaid on a continuously collapsed idealization of the terminal point-set T of the conspansive manifold, the points of which are fully collapsed tertiary syntactors already conveniently coupled in mutual identification events. Just "below" T, and interspersed with T, is the top level of N, in which inner-expanded but as-yet uncollapsed points of the manifold lie open, comprising what appears to be "empty space". This is where QM belongs, in the open states of the conspansive manifold. Below this open top stratum of N lies the deep structure of M including secondary quanta, the metacausal influence of which resolves the causal deficits associated with QM potentiae (open tertiary syntactors).

In short, spacetime is just a kind of "ectomorphic dual" of the conspansive manifold. Spacetime approximates T in the sense that objects "move" by skipping along timelike gradients like stones on the surface of a pond, their paths effectively interpolated between points generated on the surface. But unlike spacetime, the *surface itself* is regenerated with each skip of the "stone" or tertiary identity, and while spacetime can only confine its evolution to an ectomorphic scenario devoid of any extrinsic pregeometric background, T resides on an *intrinsic* background, the nonterminal domain N. T is thus adjoined to deeper structure supporting teleodynamics, which cannot reside on the surface of the manifold and is not actually supported there.

Due to these and other limitations of spacetime and the classical (Cartesian coordinate-space) model of classical physics from which spacetime evolved, QM cannot be fully modeled there, and its resulting homelessness has engendered various ontologically unsound interpretative modifications of empirical reality. QMM therefore maps potentiae to the open points of the top nonterminal stratum of the conspansive manifold, thus providing QM with a home at last.

VII. Examples of QMM Meta-interpretation

Here we give a very brief account of the application of QMM to several well-known QM interpretations, particularly those which have been mentioned in the forum discussions of *Foundations of Mind*. Please bear in mind that all mainstream interpretations of quantum mechanics are confined to the linear semimodel of M and require adjustment in order to conform to the conspansive manifold. These interpretations will be treated as tersely described in Nick Herbert's respected and highly readable classic "Quantum Reality: Beyond the New Physics" (Herbert, 1985).

Copenhagen (Bohr and Heisenberg): *There is no deep reality*. While quantum indeterminacy leaves ample room for generativity, making use of it would require acknowledgement of the nonterminal (and non-physical) domain N and the deep structure of M, which this interpretation explicitly denies. This is unfortunate, as Heisenberg erred in placing his potentiae "between the idea of an event and the actual event, [in] a strange kind of *physical* reality just in the middle between possibility and reality" (Heisenberg 1958, page 41), thus explicitly calling ideas and possibilities "physical" even when they are *physically unrealized* and therefore *not* physically real. This, of course, is semantically inconsistent; if a phrase like "physically unrealized ideas and possibilities" has any content at all, it cannot be physical in nature. We may thus infer, for the sake of consistency, that potentiae are metaphysical, which means that QM is either metaphysical and thus reliant on the metaphysical structure of reality, or merely physical and therefore needful of augmentation by deep reality in order to explain how reality identifies itself. Mere probabilistic tendencies are by definition inadequate to determine individual state transitions, and even if they are included in QM, something more is required in order to account for the self-identification of reality. It follows that the statement "there is no deeper reality than QM itself" cannot be mapped into the supertautology, and must therefore be excluded from our understanding of reality.

Observer-Created Reality (John Wheeler): *Reality comes into being through the observations of observer-participants*. Reality corresponds to the metaformal supertautology (or to its physical domain $T \subset \Sigma$), creation is mapped to generative-grammatical production by $\Gamma\mu$, and observation is mapped to secondary and tertiary identification events (i.e., to quantum measurements, and generically, to bare tertiary interactions). To the extent of its description, Wheeler's interpretation meets the standards of QMM; reality can indeed be generated by teloric observers.

Consciousness-Dependent Reality (von Neumann-Wigner-Stapp): *Consciousness creates reality*. Insofar as the generic definition of "consciousness" overlaps with the self-identification of the ontic identity and its internal self-images, it passes the test of metaformal consistency for basically the same reasons as does Observer-Created Reality.

This approach merits additional explanation. Associated with the vNWS interpretation is a "process description" of quantum dynamics. Dirac originally noted that there are two ways in which a quantum system evolves: (1) the wave function deterministically explores all possible interactions as it propagates, and (2) a single possibility is randomly actualized. In his book *Mathematical Foundations of Quantum Mechanics* (1932), John von Neumann elaborated on these modes of evolution, observing that two distinct alternating processes are transpiring: Process 1, a non-causal, nondeterministic process in which a measured particle randomly assumes one of the possible eigenstates of an observable property determined by the relationship between the particle and a measuring apparatus, and Process 2, a causal, deterministic process in which the wave function evolves between measurements according to the Schrödinger wave equation.

Henry Stapp (2007) further develops this concept by defining four (4) processes as follows:

Process 0: "Some process that is not described by contemporary quantum theory, but that determines what the so-called free choice of the experimenter will actually be"

Process 1: "The basic probing action that partitions a potential continuum of physically described possibilities into a countable set of empirically recognizable alternative possibilities"

Process 2: "The orderly mechanically controlled evolution that occurs between interventions"

Process 3: "The process that selects the outcome, Yes or No, from the probing action"; "The choice of nature"

QMM maps Stapp Process 0 to a generative event associated with a secondary telor endowed with free will (generative capacity); Process 1 is mapped to the expansion of the measured system in an eigenbasis of the telonic observable (syntactic or semantic property) in the generative syntax of the telor, priming the system's wave function for collapse; Process 2 is mapped to the underlying telic-recursive process approximated by the Schrödinger equation under ectomorphic confinement to the surface of the conspansive manifold; and Process 3 is mapped to the combined action of the primary and secondary telors on the system, which triggers the collapse. In short, QMM maps all four of Stapp's processes into the conspansive manifold.

Bohmian Mechanics (early David Bohm*): Quantum particles are ordinary objects steered by guide waves in a nonlocal pilot field.*

Bohmian mechanics is disallowed by QMM for the following reasons: (1) It is a so-called "realistic" interpretation of QM which holds that reality exists independently of the observer, precluding the crucial dynamical functionality of primary and secondary quanta (including conscious human telors); (2) It is deterministic, thus violating generativity; (3) it is fundamentally dualistic, holding the particle apart from its pilot wave (function) in such a way as to imply ontic inequivalence; and (4) It is often considered to violate the locality principle of classical physics (no superluminal influences) by requiring that the force on a point-particle instantaneously depend on the precise location of many other particles in the universe. Yet it is also widely considered to violate Bell's theorem by incorporating this nonlocal information as "hidden variables" which account for its determinism (d'Espagnat, 1979, 1989).

In the conspansive manifold, problem 4 is at least partially obviated by extended superposition, which distributes information on distant particles to every location within range of their wave functions (the scope of their inner-expanded states). Extended superposition means that no violation of locality is necessary. However, while the pilot field to some extent approximates the extended-superpositional structure of the conspansive manifold, it falsely objectivizes particles by turning them into ordinary objects which compactly persist between linear-ectomorphic state transitions, and thus commits to a form of dualism fundamentally separating medium (the pilot field) from content (the particle). Pilot waves supposedly guide particles, but in order to do so, must be determined in advance of the states of the particles themselves. Thus, field and particle are dynamically as well as structurally distinct. This is inconsistent with conspansion, whereby points of the conspansive manifold inner-expand to become their own media. Triality demands that the particle and its wave field coexist within a single identity in conspansive alternation.

The Implicate Order (late David Bohm): *Reality is an undivided wholeness*. This interpretation is rather nebulous, but if held apart from the insupportable aspects of Bohmian Mechanics, it passes in several important respects. For example, it is explicitly generative; the implicate and explicate orders correspond to Ls and Lo respectively; its wave function entanglements mirror the extended-superpositional structure of the conspansive manifold; and the holomovement (Bohm, 1980) resembles the conspansive evolution of the manifold, including telic-recursive Ls|Lo feedback over a metaformal "semantic network" of wave function entanglements and the terminally restricted flow of advanced metacausal data from Ls to Lo. While it lacks an ontology of its own due to insufficient logical support for its conceptual ingredients, Bohm's "undivided wholeness" qualifies as a limited success by QMM standards (Bohm & Hiley,1993).

Many worlds (Everett): *Reality is a multiverse of many alternate universes*. In order to circumvent the reduction of the wave function, this interpretation reifies a higher-order wave function, the so-called *universal wave function*, and associates it with physical reality as a whole. Then it lets this vast "meta-quantum" evolve "deterministically", splitting into separate universes at each quantum event.

First, the good news: Everett racked up an impressive QMM score just by proposing the existence of a cosmic wave function. With some adjustment, QMM can map it to the primary quantum of the Metaformal System, i.e., to the ontic identity as a whole. But unfortunately, this is where the correspondence ends, for wave function collapse is a basic feature of the conspansive manifold and cannot be avoided. QMM maps wave functions in general to identities consisting of superpositions of the M-semilanguages Ls and Lo, and these are not merely optional. Secondly, the evolution of semilanguage superpositions is neither temporal nor deterministic but generative, and when it comes to generative events, there is no way for the cosmic superposition of possible universes to see them coming. It could only wait for them to occur and then pretend that elsewhere they didn't, splitting the metaverse into the universe where the event and its outcome have occurred, and an "alternate universe" where they have not. Moreover, it takes more than a cosmic wave function to make an ontology, and now that a proper ontology has been discovered, it is evident that there are ontological criteria that Everett failed to take into account. At the very least, the coming-into-existence of any given alternate universe depends on these neglected criteria.

Quantum field theory (QFT): While QFT is a complex and powerful extension of the formalism of QM, its inclusion here is justified by the fact that it incorporates QM and thus involves some amount of QM interpretation. Simplistically, QFT replaces particles and wave functions with quantum fields as primitive objects, defining the particles as “excitations” of the fields which emerge analogously to wave function collapse while permitting variation in particle numbers. This much is consistent with the structure of the conspansive manifold, at least where tertiary syntactors need persist only for the duration of a single state terminated by generative or annihilative events.

But as the conspansive manifold evolves by conspansive self-dualization in generative potentialization-actualization cycles terminating on interactions of its quantum point-identities, it symmetrically dualizes the relationship, making the field internal to the points just as the points are internal to the field. The quantum fields of QFT, like the elementary particles they replace as fundamental entities, are thereby identified with the points of the manifold, i.e., with tertiary syntactors, and thus equivalently reduced to pointwise syntactic distributions. But while both QM and QFT are confined to the open top layer of N and thus superficially excluded from the deep structure of M, they are now embedded in the conspansive manifold, a “quantum metafield” where physical systems superpose directly on deeper levels of metaphysical structure and dynamics.

Lastly, it is perhaps appropriate to mention the existence of a handful of interpretations involving Lagrangianism (e.g., the Path Integral formalism of Richard Feynman), advanced causation (e.g., the Transactional Interpretation of John Cramer and its PTI variant by Ruth Kastner), or both at once.

The coupling of Lagrangianism and advanced causation may seem quite natural in the linear-ectomorphic spacetime “dynamic”. While Lagrangian mechanics requires that the initial and final states of a moving object be determined before a definite linear path can be calculated using the stationary action principle, an advanced cause serves nicely as a final state. However, in the absence of determinism, it is given by assumption rather than any sort of explanation, and so for the initial state as well. This is no less true in the quantum realm, where classical determinism is out of the question; the initial and final states of a particle must be determined before its path can be determined and used for the ectomorphic transmission of causal influences. This is the case whether causation is considered to run forward or backward, and whether the initial or final point is designated as the cause or effect … i.e., whether determinacy is retarded or advanced. This spells trouble for retrocausal theories which rely on the linear-ectomorphic transmission of advanced influences along definite linear paths, even if this is wishfully attributed to, e.g., the "back-action" of mind on a pilot field. The first requisite is to establish a generative relationship between minds and fields, and this something that only the conspansive manifold can provide.

In the CTMU, determinacy in either direction of time is superseded by generative metacausation, in which the generative action of telic identity operators gives both the initial state and final state by projecting them onto a timeline from the depths of the conspansive manifold (and which, if desired, can be factored into advanced and retarded components in spacetime despite the inadequacy of spacetime alone for mental causation).

All QM interpretations are subject to this kind of analysis, some for better and others for worse. Because QMM stands on the CTMU Metaformal System and its logical-inductive groundwork, it is unconditionally validated by the intelligibility of reality and cannot be falsified by empirical induction. In short, just as with the Metaformal System itself, there is no way out of it.

VIII. Summary

We have explained how QMM maps certain key concepts of the QM formalism, along with several popular interpretations of QM, into the supertautological CTMU Metaformal System, a true ontological metalanguage formulated in such a way as to logically support reflexive attributions of existence associated with the high-level self-identification of reality. By virtue of this mapping, QM itself, along with certain hypothetical ingredients attached to it by various interpretations dubiously claiming to provide it with an "ontology", finally have a true ontology against which they can be tested for relevance and consistency, and where those passing the standards of QMM may come to rest.

Concisely, the development can be described as follows. Any "interpretation" of A in B (or vice-versa) is a correspondence C between A and B: C:A←→B. Obviously, both A and B must be defined with some amount of coherence and precision before the correspondence C can be mapped. In any interpretation of QM, A = QM and B = reality as a whole. The problem has been that while the mathematical formalism of QM was well-defined, "reality as a whole" was not, in part because its description changes or has the potential to change with each new scientific theory or experiment. This is no longer the case; reality can now be unequivocally characterized as the supertautological and therefore rationally undeniable CTMU Metaformal System, and the true correspondence can therefore be established. By definition, QMM is that correspondence. All that remains is to apply QMM to the beasts of the quantum jungle, namely, the often strange and apparently wildly conflicting QM interpretations that have been freely proliferating at the frontier where physics meets metaphysics. It has just been demonstrated how this is done, with examples.

Nevertheless, let us explain once more *how* it was done in the clearest and briefest possible way. The CTMU Metaformal System is an intrinsic language, the involutional coupling of a language with a manifold whose points are the elements of the signature of the language, or in semiotic terminology, its "signs". This manifold is dynamic, with dual outward and inward gradients accounting for gravity and the relative linear motions of physical objects (the curvature of spacetime equates to the inner expansive gradient of the conspansive manifold, which is dual to the timelike collapse gradients of T). Its evolution can be described in terms of two operations, *conspansion* and *telic recursion*. By virtue of conspansion, the evolving manifold closely resembles the existing formalism of quantum mechanics; and by virtue of telic recursion, this formalism can be carried into the linguistic aspect of the manifold and the deep structure of the Metaformal System. (For now, we refrain from asserting that the Metaformal System is a "theory of quantum gravity", but this will no doubt eventually emerge.)

Thus, QMM is not to be confused with any mere interpretation of QM, examples of which relate to QMM as input. Rather, QMM is a "metamodel" which carries QM and its various prospective models (speculative interpretations) into the supertautological ontic identity. In short, QMM is what QM must become if it is ever to qualify as a truly reliable source of insight and authority regarding deep metaphysical questions of which the answers require certainty, generativity, and true ontological support.

Of course, there is much more to this story. But owing to space limitations, further details must be set aside for later presentation.

REFERENCES

Bohm, D. (1980). *Wholeness and the Implicate Order.* London / New York: Routledge.

Bohm, D., & Hiley, B.J. (1993). *The Undivided Universe.* London / New York: Routledge.

Bohr, N. (1928). The quantum postulate and the recent development of atomic theory. *Nature*, Vol. 121, pp. 580-590, from Bohr's Lecture at the Volta Conference at Lake Como, Italy in September, 1927. https://doi.org/10.1038/121580a0

Bohr, N. (1962). The Solvay meeting and the development of quantum physics. In, *Essays 1958-1962 on Atomic Physics and Human Knowledge.* (1963, pp. 79-100). New York: Interscience Publishers. Retrieved from: http://www.solvayinstitutes.be/pdf/Niels_Bohr.pdf

d'Espagnat, B. (1979). The quantum theory and reality. *Scientific American*, Vol. 241, No. 5, pp. 158-181.

D'Espagnat, B. (1989). *Conceptual Foundations of Quantum Mechanics*. 2nd Edition. New Jersey: Addison-Wesley Longman, Incorporated.

Heisenberg, W. Z. (1927). *Physik*, Volume 43, p. 172. https://doi.org/10.1007/BF01397280

Heisenberg. W. Z. (1958). *Physics and Philosophy*. New York: Harper.

Herbert, N. (1985). *Quantum Reality: Beyond the new physics.* Anchor Press/Doubleday: Garden City, New York.

Langan, C. M. (2017). An Introduction to Mathematical Metaphysics. *Cosmos and History: The Journal of Natural and Social Philosophy*, 13, 2, 313-330. Retrieved from: https://www.cosmosandhistory.org/index.php/journal/article/viewFile/618/1040

Langan. C. M. (2018). The Metaformal System: Completing the Theory of Language. *Cosmos and History: The Journal of Natural and Social Philosophy,* 14, 207-227. Retrieved from: https://www.cosmosandhistory.org/index.php/journal/article/viewFile/740/1214

Messiah, A. (1999). *Quantum Mechanics.* Unabridged Dover republication of the English translation originally published in two volumes by John Wiley & Sons, 1958. New York: Dover.

Stapp. H. (2007). *Mindful Universe.* Berlin: Springer-Verlag.

Von Neumann, J. (1955). *Mathematical Foundations of Quantum Mechanics, New Edition.* Princeton University Press.

Original Source: Langan, C.M. (2019). *Introduction to Quantum Metamechanics (QMM)*. Cosmos and History: The Journal of Natural and Social Philosophy. Retrieved from www.cosmosandhistory.org/index.php/journal/article/viewFile/788/1422

IQ versus EQ: A Key Interaction in Human Evolution by Michael Rose & Shea Fisker

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I. The Mensa Effect

For high-achieving individuals, attending a Mensa meeting can be an unsettling experience. Sitting at a table with very intelligent people at such meetings is quite different from interacting with a collection of distinguished professors or successful executives. The conversation is a kind of ping pong game played with words, sometimes equations. Counterpoint follows point, often in a manner that verges on non sequitur. The assembled individuals have both the openness of children, and the awkwardness of children.

This is not the high-IQ "communication range" problem of Hollingworth (e.g. 1942) or Simonton (e.g. 1999). These are individuals who are usually within 30 IQ points of each other, with IQs falling in the 135 to 170 range almost always. They are communicating with each other.

A common hypothesis is that high-IQ individuals seem childlike and awkward because they lack "EQ," a hypothetical variable that is taken to reflect "emotional intelligence" (Goleman, 1995). Definitions of emotional intelligence vary, but they have in common an ability to deal with non-cognitive problems or tasks that revolve around mastery of social interactions and regulation of inner emotional lives. But let us defer specificity about this point for the time being.

Unbeknownst to most of those who discuss issues revolving around IQ and EQ, these basic "kinds of intelligence" are in play in some of the deepest controversies about why humans evolved in the first place. We will therefore take a detour into mechanisms of human evolution before returning to questions involving the daily lives of the highly intelligent.

II. Selection Theories for the Evolution of the Human Brain

We know two things. First, intelligence is a brain function. That much is obvious. Second, there is clear evidence for significant changes in brain size during hominin evolution over the last four million years, because brain size can be estimated from fossil crania. While there are gaps in the hominin fossil record, they are being filled by a trickle of new discoveries of specimens from Africa. There are ambiguities in the inference of increasing brain size during hominin evolution: the dating of fossils, guesswork in the reconstruction of skulls from their fragments, variation in adult brain sizes within species, and finally sampling error due to the small number of hominin fossils. Nonetheless, it is reasonable to conclude that the average brain size of members of our ancestral lineage has increased from about 400 cc around 4-5 million years ago to an average of around 1400 cc by about 200,000 years ago (Wood 2005). While our adult body sizes increased over this period, our brain sizes increased at a substantially faster rate. After all, gorillas have brains that are much smaller than ours.

This increase in brain tissue has been associated with many secondary transformations of human biology. The large head of the human neonate is a major cause of perinatal mortality, both for itself and for its mother (Ellis 1973). Or at least it was before the advent of routinely successful Cesarean sections allowed high rates of survival for both mother and child. The human neonate is highly altricial, requiring extensive care and protection to survive. After all, the newborn human is a highly dependent, immobile, vulnerable mammal. Furthermore, it remains that way for more than a year, during which it is usually not even able to walk. One interpretation of the human pattern of child development is that the human infant is really a fetus for its first 12-18 months. The evolutionary problem was probably the difficulty of giving birth to a one-year old human. Women's pelvises simply aren't big enough for that task. Even with the radical transformation of the early months of human development, the human female pelvis has been substantially remodeled in a manner that often interferes with locomotion at the limits of running speed, in order to accommodate the large head of the neonate.

The energetic costs of human pregnancy and lactation are considerable. Adult brain tissue is also the most costly tissue from the standpoint of both basal metabolism and volume of blood flow per unit weight; brain metabolism can use up to 40% of the calories expended by the human body, with an average around 20-25% (Leonard & Robertson 1993). All of these attributes imply the action of evolutionary mechanisms that powerfully selected for a large and powerful brain.

Clearly, the human physiognomy has been remodeled in the course of the evolution of the human brain, and at some expense to other functions. The human brain has ‘cost’ a lot to evolve, in terms of ancillary adaptations. It cannot be a neutral attribute.

Our large brains must have been actively maintained by strong natural selection favoring their use in ways that increase our Darwinian fitness, at least up until 1900, if not up until the present day.

Our brains must have first evolved because of strong selection for some type of intelligence. And this type of selection also must have been sustained up until the 20th Century, to forestall the rapid selective diminution of our brain sizes (Teotónio & Rose 2000). Rose proposed a scenario for human evolution in 1980: the mental arms race amplifier (Rose 1980). According to this theory, human behavioral versatility evolved as a result of selection on general-purpose facilities for calculating the fitness consequences of complex sequences of behavior, choosing among such behaviors according to their consequences for individual fitness, and then carrying out such behaviors. The key point is why natural selection favored the large brain required for such cumbersome determination of behavior. To explain the significance of the mental arms amplifier model, we begin by reviewing the basic types of theory that have been proposed for the explanation of human evolution.

Many theories of human evolution involve specific scenarios for human ecology in Africa millions of years ago: bad weather, a reliance on hunting, the use of dexterous fingers to handle seeds, the behavioral self-control to sustain monogamy, and a division of roles between the sexes, et cetera (Lovejoy 1981). While these theories are often ingenious, and may indeed correctly capture details of our evolution, in the absence of time machines they are very difficult to test scientifically. Instead of pursuing such detailed and usually untestable scenarios (Rose 1998), we lump past theories of human evolution into two broad categories: selection for “technical intelligence” (think IQ) and selection for “social intelligence” (think EQ). We also subsume within these categories specific behavioral adaptations: language, calculation of spatial location, managing one’s personal database of friends or enemies, etc. This is not to deny the existence of such specific functional components within the broad technical and social modes of brain function, where such specificity may involve both foci for selection and localization of such functions within the brain. For now, however, our intent is to bring forward salient empirical differences between the two main arenas for natural selection on human brain function.

To be more explicit about our terminology, the word “technical” here refers to behaviors that enable us to defend ourselves against predators, obtain food, water, or shelter, and so on.

Another term that we sometimes use for this type of facility is “ecological” functioning. But such brain functions could also be described as “cognitive,” and their relevance to measures of IQ are evident. The idea is that this capacity pertains to our interactions with the material environment, stripped of such behavioral functions as obtaining a mate, instructing children, forming social alliances, and so on. The latter category of behavior we refer to as “social.” The relevance of EQ or emotional intelligence to such functions is again evident.

A particular pursuit, such as that of a small group of hunters or foragers, might involve social and technical facilities simultaneously. This type of simultaneous function will indeed turn out to be critical for our analysis of human evolution. But the terminological slice provided by the technical/social, or IQ versus EQ, dichotomy is necessary for analytical clarity.

Upright bipedalism and a fairly large brain gave early hominins, such as the australopithecines (Wood 2005), the opportunity to learn how to use tools with their forelimbs, and our manual anatomy has evidently evolved as a result of this function. There is abundant direct and indirect evidence for the use of hand-held tools over some millions of years of hominin evolution (McPherron et al., 2010). Primates other than hominins use simple, learned technologies, such as chimpanzees probing for insects with twigs (Boesch & Boesch-Achermann 2000). Thus, presuming longstanding tool use by our ancestors is not controversial.

The use of hand-held tools to obtain food or to fabricate shelter is a dramatically distinctive feature of human life. Engels made the additional proposal that tool use for material purposes was key to human evolution in an 1876 essay (Engels 1876) entitled, "The part played by labor in the transition from ape to man."

This idea has been advanced, burnished, and elaborated on many times since. In 1959, Oakley (Oakley 1959) pointed out that tools made humans "the most adaptable of all creatures," and that the use of tools may have been responsible for the evolution of human mental powers. Oakley did not offer a selection mechanism defining precisely how this occurred. In 1960, Sherry Washburn (Washburn 1960) suggested that positive feedback for tool-use led to consistent bipedality, resulting in a novel human ecology. Consequently, selection on many parts of the body increased the ecological advantages of human tool-use still further: "The huge advantage that a stone tool gives to its user must be tried to be appreciated. Held in the hand, it can be used for pounding, digging or scraping. Flesh and bone can be cut with a flaked chip, and what would be a mild blow with a fist becomes lethal with a rock in the hand." Tools can also be used to make other implements, such as containers for carrying and storing food. Washburn thus proposed that the key to human evolution is our adoption of a tool-use ecological niche.

But there are problems with this IQ-only type of theory for the evolution of human behavior. The obvious power of present-day human technologies blinds us to the fact that the period during which the human brain evolved its present size occurred long before civilization, the invention of writing, or indeed the use of metal tools. Furthermore, the indigenous Tasmanian people had minimal tool-use, possibly not even fire (McGrew 1987). Other hunter-gatherer societies still use extremely simple tools (Byrne & Whiten 1988).

Also, despite such long-standing differences in material culture among human populations, and the powerful selection against having a large brain, there are no clear differences between human populations in their level of intelligence. Again, it must be borne in mind that relaxing selection on such a problematic, and perinatally acutely dangerous, character as a large brain size is expected to lead to its rapid diminution, as shown by experimental evolution research with other characters that have such trade-offs (Estes & Teotónio 2009).

On the other hand, complex social behavior is a universal feature of human populations: elaborate rituals for coming-of age, marriage, and the mourning of the dead; gossip; hierarchies and declamations revolving around the allocation of power; epic poetry and other fictions concerning human conflict, from tribal legends to soap opera. Is it plausible that such a compulsively sociable species could have evolved a large, dangerous, and metabolically expensive brain solely to be able to produce a stone tool with a slightly better pattern of flaking?

These and other anomalies have led some scientists, particularly anthropologists, to propose theories of human evolution based on selection for some type of “social” calculation. In other words, it has been proposed that humans evolved substantial increases in emotionally focused intelligence primarily for the purpose of intraspecific conflict and cooperation. This is the “social intelligence” model for human evolution. In such theories, human evolution was all about EQ, not IQ.

This theory too has been discovered and rediscovered repeatedly, since Charles Darwin (1871) first suggested it in his book *The Descent of Man.* We call such selection mechanisms “mental arms races.” However, in some versions of mental arms race theory, an initial period of selection for ecologically useful tool use is presumed, and thus selection for IQ. This is a plausible assumption for hominin evolution generally, because it is likely that all hominin species used hand-held tools over the last four to five million years. During most of this period, hominins had fairly efficient upright bipedalism, and thus better opportunities for tool-use than the knuckle-walking chimpanzees who use tools themselves. It is necessary to account for the evolution of human-scale intelligence *after* the initial adoption of bipedalism and simple tool-use. This helps motivate the general idea of selection for some type of social intelligence (or EQ) *in addition to* selection for the capacity to learn how to use simple tools (or IQ).

There are a variety of contexts in which social intelligence could be selectively favored: courtship; intrasexual competition for mating opportunities; competition for access to food, territory, etc. There are a wealth of contexts where being more socially adept might be beneficial for a social vertebrate like ourselves. It takes little imagination to see that numerous advantages would accrue to those who could outwit and thereby exploit potential mates and competitors within one’s species. And as such socially-exploitative strategies evolved, they would foster selection for the evolution of counterstrategies, such as cheater-detection. This type of social-intelligence mental arms race is a fairly obvious theory with which to explain the evolution of high levels of intelligence.

Humphrey (1976) is one of the more articulate expositors of social intelligence theory. He has emphasized that most practical problems to do with the physical environment do not require much inventiveness, and this is obviously true of most subsistence level hunter-gatherer societies. The crafts of such societies can be passed on easily from one individual to another. To quote Humphrey: "subsistence technology, rather than requiring intelligence, may actually become a substitute for it” (1976, p.306). Unlike the physical environment, the social realm continually presents new problems requiring creative solutions.

> *One animal may, for instance, wish by its own behavior to change the behavior of another; but since the second animal is itself reactive and intelligent the interaction soon becomes a two-way argument where each 'player' must be ready to change its tactics - and maybe its goals - as the game proceeds. Thus,*

> *over and above the cognitive skills which are required merely to perceive the current state of play (and they may be considerable), the social gamesman, like the chess player, must be capable of a special sort of forward planning. Given that each move in the game may call forth several alternative responses from the other player, this forward planning will take the form of a decision tree, having its root in the current situation and growing branches corresponding to the possible moves considered in looking ahead. This asks for a level of intelligence which is, we submit, unparalleled in any other sphere of living.* (Humphrey, 1976, p.309)

Experimental studies of the social intelligence of primates have become common, partly thanks to Humphrey's influence (Byrne & Whiten 1988). One of their themes is the ability to "mindread": predicting the behavior of others or manipulating them, based on an apparent internal representation of the minds of conspecifics. For example, intentional deception is thought to depend on such mindreading. But while nonhuman primates have more mindreading ability than vertebrates from other taxonomic groups, their social intelligence does not rise above that of a four-year-old human. And their technical intelligence is certainly worse than that of human hunter-gatherers, despite the evidence that primate and human tool-use weren't radically different, as discussed previously, before the onset of agricultural civilizations.

The recent focus on social intelligence in other primate species raises an embarrassing problem for social intelligence theories of human evolution. Why shouldn't every social vertebrate have higher intelligence, if it is always and only about EQ? Birds often live in large colonies that feature endless squabbles over nesting space, food, and sex. Many bird species have social interactions that achieve considerable complexity, with ownership of territories, lifelong pairing and consequent adultery, polygamy, dominance, and so on.[r] Why hasn't the social intelligence selection process produced large brain sizes, language, and tribal politics in colonial birds? [And if flight imposes a mechanical constraint, why wouldn't bird evolution favor the evolution of large brains over the evolution of more efficient flight, if selection for social intelligence is such a powerful force among social species?] If selection for social intelligence is so powerful, why do humans alone possess languages with large vocabularies and complex elaborations of material culture?

The key to resolving this problem lies in the unusual setting that extensive learned tool-use provides for selection on social intelligence. Again, this idea has been broached repeatedly.

Hand-held tools that are used for hunting large animals can also be used to injure or kill other humans in armed combat. This is a central fact that conditions human evolution. A variety of authors have pointed out that armed combat could have generated intense selection for the intelligence to invent and use weapons with deadly force (e.g. Bigelow 1969). Moreover, armed conflict would create clear advantages to those individuals who adopt better tactics, including alliances for joint attack or defense. This is a much better context for the invocation of Darwinian selection than that of gossip, to give a contrasting example, because armed combat can produce large effects on fitness, thanks to death, castration, and other misadventures of battle.

Using evolutionary game theory, Rose developed this rather generic line of thought in a specific direction that we think is more appropriate to the initiation of human evolution, especially the massive expansion of our brains *after* tool-use became a common part of our behavioral repertoire (Rose 1980). Consider the problem of two stags fighting for the opportunity to mate with a deer. In evolutionary game theory, this situation is analyzed in terms of alternative strategies like Hawk, Dove, Bourgeois, etc. (Maynard Smith 1982). These are each candidate evolutionarily stable strategies (ESSs). ESSs arise from particular game contexts. In the case of a stag contest, this context includes how many deer there are to mate with, how sharp the antlers of the other stags are, how fragile antlers are, and so on. These are all biological variables that will in turn depend on the functional morphology, ecology, and physiology of the particular deer species. And these contest determinants cannot be deliberately altered by the contesting stags. Most animals can't break the rules, or "cheat," in their evolutionary games, because the game rules are set by the biology of their species. This is why evolutionary game theory works. Evolutionary games have stable rules, because the overall contexts for conflict are stable within each animal species.

But this constraint does not apply to hominins that use tools in armed combat. Among such hominins, the evolutionary game contexts in which they have their conflicts will not be stably determined by their general species biology. Unlike antlers, horns, claws, or fangs, hominin hand-held weapons were not built-in; their design, fabrication, and use was not specified by genetic inheritance. As such, they would not establish a stable evolutionary game.

Thus, armed combat among hominins undermined the consistency with which their conflicts would produce an evolutionarily stable strategy. And the more proficient, complex, and culturally-dependent armed combat within hominin species becomes, the less useful genetically-fixed social strategies would be in such combat. Conventional evolutionary game theory becomes irrelevant to the prediction of the evolution of social behavior in such species, though this is of more importance for academics than for evolving humans. The problem for our evolving ancestors was that relative strategic advantage depended more on the facility with which novel and appropriate tactics could be improvised quickly, rather than on the evolution of a good standard strategy specifying the specific circumstances under which a standard set of tactics are to be used.

This supplies a connection between materially-proficient tool use (IQ) and selection for sophisticated social intelligence (EQ). Proficient use of deadly hand-held weaponry is offered as the explosive material that set off the evolution of high levels of social intelligence. On this theory, social stereotypy became a liability for our hominin ancestors, unlike the situation for birds, in which classic ESS behavior patterns are typical among conflicting individuals.

The invention of new weapons or tactics in our ancestors thereby created a second-level evolutionary game. In a species that is continually being confronted with changes to the rules of its evolutionary games, the most successful game strategy will often be one that is determined by direct calculation, not genetic specification. Armed combat selects for immanent calculation of social strategies; that is, it selects for versatile social intelligence, or EQ. This conclusion is underscored by a reasonable likelihood that players who use such immanent strategy-calculation should often be able to readily exploit or counter the actions of players who use any stereotypical strategy, including behavior patterns that would be typical ESSs in species that lack armed combat, contributing to EQ.

This evolutionary scenario evidently produces a kind of mental arms race in which the key adaptation is the capacity for, and speed of, calculation for the purpose of inventing new social strategies by each player. Those who could calculate more moves in advance, taking into account more of the novel features defining the outcome of each interaction, would have the selective advantage. Those who are chess-players will find this evolutionary problematique familiar. Chess players are caught up in an analogous arms race, as explicitly noted by Humphrey in the quotation above.

But before proceeding further with this attractive theory for the evolution of free will, there is a major problem facing mental arms race selection. That is the fitness cost of investment in strategy-calculation; having a very large brain is not free. And having a very large brain when the neonate passes through the pelvic opening of an upright biped is extremely hazardous. Therefore, opposed to any conjectural Darwinian benefits of open-ended strategy calculation are the Darwinian costs of an enlarged metabolically active brain. Theories of social intelligence that ignore this problem are like fantasies about the benefits of space travel that do not incorporate the material difficulties and costs of rocketry.

In terms of evolutionary theory, investing in strategy calculation has the properties of frequency-dependence that define evolutionary games. Investment in strategy-calculation is a “bidding” or “display” game, in which the highest bid is expected to win, while the lower bids lose. Together with John Haigh, Rose published an analysis of the expected outcomes from such calculator games and others like them (Haigh & Rose 1980). They called such bidding contests “evolutionary game auctions.” It was an important feature of their analysis that they did *not* assume that there will be perfect detection of the bidding level of opponents. That is, they allowed the possibility of overinvestment in players with aggressive bidding strategies. This is the appropriate assumption when contest bids involve investments in the growth of material structures, like brains, antlers, fighting limbs, et cetera, where such investments can involve biological materials, energetic resources, delayed maturation during a protracted period of growth, and so on.

The results of the Haigh and Rose (1980) analysis were somewhat surprising: if investment in open-ended strategy calculation is costly, in fitness terms, then the evolutionary outcome is a distribution of investments from zero to a rough cut-off. After the cut-off point, investment plummets to zero. This implies that a mental arms race might increase the upper-end of the distribution of investment in social intelligence, or EQ, but it will not increase the minimum of that distribution. If this were the appropriate model for human brain evolution, then we should have numerous individuals in human populations with the emotional intelligence of small-brained hominins, an intelligence arguably not much greater than that of contemporary chimpanzee species.

Our interpretation of this finding is that no mental arms race, by itself, could have generated the spectacular increase in brain size and intelligence which led to present-day humans. Thus, despite the intuitive plausibility of the many different mental arms race scenarios that have been proposed over the last 150 years, the hypothesis is not viable.

But on the other hand, the criticisms that social intelligence theorists have made of simple technical intelligence, or IQ, theories of human evolution are also telling. Selection for subsistence-level, hunter-gatherer, tool use is not a plausible mechanism for trebling the brain size of a hominin that was probably already using tools with some efficiency. Thus, technical intelligence theories of human evolution are also moribund.

The alternative is obvious, and as it turns out much more robust. For components of intelligence that can be used for *both* technical and social calculation, both IQ and EQ, the prospects for rapid evolutionary transformation are considerable. For now, don't be too concerned about the specific nature of such intelligence-enabling brain functions. Pay attention to the interplay between the two types of selection.

First, consider a cognitive, or strictly IQ, function for which the ecological benefits and life-historical costs exactly balance. Say this function enhances the organism's ability to avoid capture by a predator by some percentage, giving a survival benefit. But say the exact same numbers of children (perhaps) who would survive such predation instead die during birth because of the slight increase in brain size required. Under such conditions, natural selection will not favor striking investment in this brain function, all other things being equal. The benefits and costs cancel out.

But what if this brain function also gives those who possess it the ability to detect dangers posed by predatory opponents within their species? That is, this capacity increases social intelligence (EQ) in this particular respect. In this scenario, the costs of this 'social' enemy-detection capacity are evolutionarily paid for by its ecological benefits. The mental arms race becomes free. In the terminology of the Rose (1980) mental arms race amplifier paper, this is a case of "perfect amplification" of a mental arms race. The theoretical expectation then is that, for characters like this generalized enemy-detection capacity, the amplified mental arms race should produce rapid increases in enemy-detection, which would then be manifest anatomically as a small increase in total brain size.

Imagine, now, a number of these general-purpose brain functions, useful for both ecological purposes and in social competition, increasing both IQ and EQ. The list of these brain functions might look this: enemy-detection; tactical improvisation; sequential planning; attention to side-effects; empathic modeling of the minds of conspecifics, predators, and prey; etc. The ecological benefits of such general-purpose calculation of fitness-relevant contingencies, and their effective use in the orchestration of behavior, could evolutionarily pay for their use in the mental arms race. Under these conditions, we can expect an explosive increase in generalized intelligence, with an associated increase in brain size during the evolutionary process. IQ and EQ would thus increase in tandem, creating an upward spiral in *general* intelligence functions that could be used in both technological and social contexts.

The flaw in this model is obvious: it is unreasonable to expect that ecological benefits and life-historical costs would exactly balance over all levels of investment in intelligence. But this is where the features of the eventual evolutionary outcome of mental arms races come into play. Mental arms races, when there is a net cost to investment in such arms races, generate a smear of investment in social intelligence starting at the point where the investment becomes costly in its collateral effects on Darwinian fitness. Imagine, therefore, a fluctuating cost function for each particular component of social intelligence (EQ), in terms of its utility in non-social problem-solving (IQ). That is, suppose that the cost function is sometimes positive-valued and sometimes negative-valued. When further increases in such generalized brain functions are of net benefit outside of the social competition, the mental arms race will be accelerated by ecological selection. With a perfect balance, the mental arms race will be cost-free, and proceed quickly.

But when there is a range of brain investments that are costly in their net effect on fitness outside of the mental arms race arena, the mental arms race will generate a smear of brain investments from that point upward. If, at a still higher level of brain investment, the net effect of the brain investment outside of social competition becomes beneficial again, the mental arms race will 'bridge' the range of investment values over which the investment is costly. Such "other side of the bridge" individuals will reap great rewards again, and the mental arms race will be accelerated once more. This is the mental arms race amplifier ("MARA") theory. MARA theory predicts the evolution of extremely high levels of investment in generalized brain functions, brain functions that must be useful for *either* social problem-solving or non-social problem-solving, enhancing EQ and IQ together. And it is very important to understand that *only* such generalized problem-solving capacities would be selectively favored as they proceed to higher and higher levels. Hypertrophied but costly brain functions that enhance fitness *only* via social or technical intelligence (either IQ or EQ) are not expected to evolve to high levels, since their limited benefits would not exceed their overall associated costs, although some such specialized brain functions could certainly evolve to a lesser extent. Thus, this model predicts the evolution of a generalized intelligence, *not* one made up of hypertrophied problem-solving components that are specific to particular forms of social or technological problem-solving, forms of intelligence that are locked-on to specific or stereotypical patterns, IQ only or EQ only.

III. The Central MARA Trade-Off

It is a fairly straightforward application of the underlying mathematical theory that there should be a wide range of variation in the *relative* allocation of calculation between technical and social functions, among individual members of a MARA species that have reached evolutionary equilibrium. Recall what the “technical” and “social” adjectives refer to, in terms of their specific behavioral domains. “Technical” here refers to problem-solving that subserves functions like acquiring food, avoiding predators or disease, surviving environmental threats like floods, and so on. In other words, material problem solving, such as IQ and other cognitive tests might measure: inferential processing, memory, discerning acoustic or visual patterns, and so on. The benefits from this type of calculation are not inherently frequency-dependent, in a competitive manner. It doesn’t usually matter how many others figure out that they should flee from a tsunami, so long as you do.

“Social” calculation, or “emotional intelligence,” refers to calculations that concern competition among individuals within MARA species. Here the benefits are strikingly frequency-dependent. It *does* matter whether a MARA individual is tactically and strategically better in their interactions with its conspecifics, because *relative* advantage is key to reproductive success. To be tawdry about this, think of the *Bachelor* and *Bachelorette* reality TV shows, in which the point is to be chosen relative to the rest of the field. Painful to contemplate, but such programs make elements of evolutionary game theory quite clear in their relevance to human behavior, albeit in a grossly disfigured version of what humans prefer to do with greater subtlety, taste, and discretion in their everyday lives. Under MARA conditions, however, natural selection will produce very high levels of both technical and social types of calculation, because it is a selection mechanism that can only work effectively in species where there is the possibility of deploying the same calculation resources for *both* purposes, not necessarily minute by minute, but over a lifetime.

Yet, when MARA selection finally comes to an equilibrium, the effects of frequency-dependence will take over so as to produce a culminating smear in which some individuals invest more in social calculation than others (Rose 1980). But, functionally speaking, what will such a terminal smear entail?

While all individuals without a major pathology in a MARA species will have qualitatively much greater calculation capacities in both technical and social contexts compared to non-MARA animals, the allocative smear between technical and social calculation (IQ versus EQ) will lead to wide variation in the ability of MARA individuals within the same population to perform technical versus social calculations. In contemporary slang, this will produce a spread from the “nerdy” to the “cool.” There will be some individuals who will develop relatively less social finesse, but will be relatively good at solving material problems; they will have higher IQs, but be “socially awkward.” Other individuals will be socially adept, but will struggle to solve purely technical problems, such as those of mathematics; they will have higher EQs, but be relatively poor at purely cognitive tasks. And there will be a spread of individuals in between, who are less extreme in their social and technical intelligences. The underlying theory does *not* support the likelihood of a typological disparity, with the population being composed of only two main types, the nerdy and the cool.

There is a second, very important, corollary of this theory that was emphasized in Rose (1980): this terminal smear will greatly reduce the tendency of long-separated MARA populations from the same species to show major differences with respect to the balance between technical and social intelligences (Rose 1980). Disparate environments will generate different points in the scale of investment in general calculation-capacity at which the eventually non-amplified mental arms race produces a smear of investments, and thus change the minimum value of the smear that selection will generate. But the broad, terminal, equilibrium smear will obscure this effect. The different minimums will be washed out by the larger, shared range.

This is a fairly abstract point, but its application to the human example nonetheless has some interesting features. Let us take up the second corollary, just adduced, first. With MARA selection, this corollary suggests a relative lack of distinctive differentiation between long-separated human populations with respect to their relative investment in technical versus social calculation. If our species were different in this respect, there could indeed be a “master race,” that could outwit and dominate members of other human populations. In effect, investment in social intelligence or technical intelligence could be so distinctive between human populations that individuals from some of them could readily dominate those from other populations, if a terminal MARA smear had not been generated by evolution.

Note also that just such a striking differentiation with respect to the combined overall calculating capacities could arise in separate MARA species, as different species could have equilibrium spectra of investment in social versus technical intelligence that are radically different. In such cases, one or the other MARA species should be able to utterly dominate the other, leading to the destruction or enslavement of the species that have evolved a non-overlapping, left-shifted (that is, lower-valued), distribution of investment in open-ended calculation. This may explain why there is only one MARA species on Earth at the present time; the Neanderthal and the other hominin species may have been driven to extinction due to a lack of ability to compete with our immediate *Homo sapiens* ancestors, in turn due to an inferior aggregate level of social and technical intelligences in these other species.

But the trickiest point for the present purpose is the nature of the spread of allocations to social intelligence within a MARA species at evolutionary equilibrium. At the core of the original Haigh and Rose (1980) analysis is the assumption that there can be some kind of partial reallocation of the investment in the social competition between individuals. In the case of the application of this theory to MARA selection, this would involve a reallocation of calculation resources from social intelligence back to technical intelligence. Thus, inherent in this type of theory is the possibility of a shift of resources between social and technical functions, between EQ and IQ, respectively. In effect, those who invest little specifically in social calculation, at the terminus of the long evolutionary process that produces organisms with enormous general purpose intelligence, should garner greater resources for technical calculation, and *vice versa.* These trade-offs are not expected to be perfect, and they are further expected to be obscured by the presence of individuals who are generally pathological, but they are expected to arise among those who have good general calculating capacities.

IV. The Ludwig Study of "Greatness"

So, what is the evidence that such trade-offs, reallocations, and broad phenotypic variation in fact arise? Those who suffered the slings and arrows of American high schools, particularly since the 1950s, will be familiar with its Hobbesian, if not indeed feral, sieving of students into nerdy low-status groups and cool high-status groups. Superficially, this looks very much the pattern being considered here. “If you want to get good grades and stuff, you just can’t be cool.” This is a prevailing American social ideology, but it is open to question on empirical grounds.

At the level of the biographies of well-known individuals, where there is somewhat more objectivity, there are a number of crude contrasts that can be brought forward. Those who know Isaac Newton’s life-story in reasonable detail will know that he combined one of the most powerful technical intellects known in history (and thus a very high IQ) with one of the most depauperate personal lives (and thus a low EQ). He never married, and his few emotional attachments as a mature adult, such as to his niece, seem to have been awkward, if not indeed infantile. He was notorious for his in-fighting with other academics, and actively enjoyed attending executions. Newton is not known to have reproduced, or even to have had a sex life after his student years.

Then there is the famous case of William James Sidis, one of the more notorious prodigies of the 20th Century (Wallace 1986). This was a man who had a vast capacity for processing information at a high cognitive level, as opposed to the calculating stunts of autistic savants which are usually at a lower level of computational sophistication. He learned to read at one year of age, and his subsequent linguistic facility was prodigious, particularly with respect to the speed with which he could learn new languages. He received a PhD in mathematics as a teenager, and became a faculty member at an American university. But he could hardly cope with adult life, not even within the indulgent environment of 20th Century American universities. He soon abandoned his academic career, and moved from job to job, which were characteristically jobs where he could use his supreme intellect to minimize the amount of trouble he had to expend to fulfill the obligations of his employment. His chief adult passion was collecting transfer tickets from mass transit. He apparently fell in love with a woman once, but his approaches to her were ineffective and eventually came to nothing. His temperament was unreliable, alternating between passive and disputatious. His manners were characteristically uncouth and unappreciated, his dress and hygiene unimpressive. He is not known to have ever reproduced. This was an individual with miniscule social intelligence, a low EQ.

Many readers at this point will be thinking of their socially dysfunctional professors, or indeed the proverbial computer “dork” who is excellent with machines but hopeless with people. But such anecdotal and ill-formed information calls out for a more objective characterization and distillation. Unfortunately, there is no currently active body of social science research that is devoted to addressing the distribution of allocation between technical and social intelligence, IQ versus EQ. There isn't the theoretical motivation for social scientists to test the present ideas.

But there is one research study that sheds some sideways light on the question of the spectrum of allocation between social and technical intelligences, and thus EQ versus IQ. This is the work of Arnold M. Ludwig, as published in his 1995 book, *The Price of Greatness.*[I] There are two particularly useful aspects of this project. First, it was performed by a psychiatrist, which ensured a fair degree of sophistication in the characterization of the personalities and lives of the subjects of the study. Second, it was highly quantitative, with careful attention to a variety of statistical artifacts that are often not handled appropriately, such as properly allowing for unequal sample sizes and avoidance of 'data-snooping' when overall statistical tests are not significant.

Ludwig was particularly interested in the relationship between clinical psychopathology and the attainment of high levels of creative achievement. Ludwig's findings show that there is little support for a positive correlation between creativity and psychosis or the abuse of illegal substances, contrary to many popular myths. There is some evidence for an association between creativity and moderate tendencies to depression or alcoholism, but this pattern is not particularly striking, at least in our opinion.

Here we will argue that Ludwig's study instead reveals a striking correlation of a very different kind, though not one that he himself draws particular attention to. In order to see the twist that we wish to apply to Ludwig's data, it is important to be cognizant of (i) what the raw data were, and (ii) how he classified them. Ludwig's raw data were derived from biographies, although not any kind of biography would do. Specifically, he selected biographies that had been reviewed in the *New York Times Book Review* between 1960 and 1990, further restricting the sample to those who "belonged to Western culture and had lived during the 20th Century" (1995, p. 25). He focused only on deceased individuals, which prevented potential libel actions from diminishing the accuracy of the biographical material. He required that there be at least one comprehensive and well-documented biography published about each person, whether or not that particular biography was reviewed by the *NY Times.* He further excluded those who had achieved notoriety as a result of criminal activity, disaster, or other sensational events. In other words, he was seeking data on the eminent, rather than the merely notorious.

For our purpose, the value of the data that Ludwig analyzed lies in the extent to which they reveal more of the 'whole person,' rather than the attenuated characterizations which are the more typical databases of social science studies, such as the notorious multiple-choice questionnaires which are the staple of such research. Furthermore, most social science tends to be based on theoretical constructs that are often irrelevant from the present perspective, making their databases of even more limited value, due to their focus on constructs that have nothing to do with the hypotheses that we wish to explore here. But Ludwig's study gives a relatively unprejudiced and quantitative characterization of a large sample of individuals whose lives in turn have been at least reasonably well-documented.

After proceeding through extensive analyses that sift through conventional hypotheses about "creativity and madness," generally finding little that is particularly revelatory, in his last chapter, Ludwig (1995) reports the most striking statistical finding that emerged from his study as a whole. It was obtained in the following manner: He sought to determine the attributes which differentiated the 'truly eminent' from the 'merely eminent.' But his quantitative measure for magnitude of eminence was biased in a way that turns out to be useful for the present purpose. Here are his own headings for the components of his eminence calculation: posthumous recognition, universality of contributions, setting new directions, influence on other professionals, originality, extent of innovative accomplishments, versatility, productivity, contemporary (meaning during the life of the eminent person) fame, and skill. It is not our interest to defend or attack these criteria, or the way they were combined quantitatively to produce a metric of 'true greatness,' Ludwig's "Creative Achievement Scale" or "CAS."

The interesting point is that this metric divided the 'eminent' people in Ludwig's overall sample into two distinctive groups. The first group was primarily made up of those who are "Artistic" or "Investigative," in Ludwig's usage. This is a group chiefly consisting of painters, architects, novelists, poets, musicians, and scientists. This group consistently received higher scores on the CAS measure. The second group was primarily made up of the "Enterprising" or "Social," those who had achieved eminence in the worlds of business, exploration, military service, public office, social activism, sports, or were merely the acclaimed 'companions' to others. [For examples of 'companions' in the sample, there are Jennie Churchill, husband of Randolph Churchill and mother of Winston Churchill, as well as Clara Ford, wife of Henry Ford.] This second group achieved consistently lower eminence scores on Ludwig's CAS. Specifically, the

Artistic were to be found in the highest quartile of his sample 78% of the time, and likewise the Investigative (chiefly scientists) were in this top quartile in 81% of the instances. By contrast, Enterprising and Social individuals from Ludwig's second group made it into the ranks of the relatively still more eminent only 10% and 23% of the time, respectively. While it is flattering to artists and scientists to be so consistently accorded the status of truly great compared to business leaders or politicians, Ludwig's quantitative ranking of the different levels of 'true greatness' between these two groups is of no interest here. [And no doubt many politicians and business leaders would reject their relatively lower rankings, at least in their private thoughts.]

What is intriguing about Ludwig's contrast are the distinguishing features of the biographies of these two groups *other* than their relative eminence, when these two groups are statistically contrasted with each other, separately from Ludwig's dubious allocation of relative merit or "greatness" between them. These other features strikingly differentiate these two groups, with an aggregate predictive correlation of 92% accuracy. Precisely inverted, then, Ludwig's predictive correlates of eminence can be used as inadvertent characterizations of the features of those whose achievements are in scientific and artistic domains versus social, political, or business domains. That is to say, Ludwig's data analysis offers a quantitative characterization of a large (more than 1,000 subjects) database of people who achieved remarkable feats with respect to what could be roughly characterized as either technical intelligence (a broad version of IQ) or social intelligence (EQ broadly construed).

It is important to understand the unusual value of data like this for characterizing patterns of trade-offs. Trade-offs are not readily uncovered using 'poor' biological material; rather they are most readily studied using the pattern of correlation among functional characters when organisms are generally functioning at high levels of Darwinian fitness (Rose 1991). Thus, psychiatric studies that concern correlations among the risk factors associated with patient populations are systematically biased away from the detection of trade-offs and their consequences in human populations in general. By contrast, Ludwig's study is particularly useful as a way to characterize trade-offs associated with extremes of investment in technical versus social calculation, as the individuals in his study evidently perform closer to the upper limits of human function, rather than the limits of human dysfunction. And of particular note for the empirical evaluation of behavioral trade-offs will be associations between failures or impairments of *some* functions associated with high levels observed for *other* functions.

The contrast between the eminent creative artists or scientists versus the social, political, and otherwise enterprising eminent individuals provides a test of the extent to which eminence in technical intelligence (broad IQ) is associated with trade-offs in EQ functions. Fortunately, in Chapter Nine of his book, Ludwig provides an extensive profile of the attributes of his 'technically,' as opposed to 'socially,' eminent individuals, where it should be clearly understood that this is our interpretation of the contrasting groups that he identifies, not his. Here we will summarize that profile using, from Chapter 9 of *The Price of Greatness,* Ludwig's own headings as well as quotations from his book selected in order to do some justice to his more extensive prose delineation:

A. Special Ability

1. "extraordinary talents, abilities, or gifts as youths" (p. 181), with examples including perfect pitch, photographic memory, linguistic facility, and great ability to grasp complex concepts. There is the possibility that these abilities were not necessarily achieved as a result of extensive training, such training being explicitly contrasted from such initial, childhood, or adolescent abilities. Note that this item implicitly indicates that such abilities are in fact not required to be eminent in social or political roles.

2. "thoroughly trained and grounded in their particular fields" (p. 181), in which respect Ludwig draws attention to the need for a protracted period of intensive training or education in the particular types of expertise required for a specific creative endeavor. Note that such training is not required for achievement in social or political realms, by Ludwig's statistical analysis.

3. "self-learners, and do more than their formal training requires them to" (p 182), suggesting an almost voracious determination or drive to acquire more skills or knowledge in their chosen area(s) of creative achievement. Somewhat associated with this is a pattern of incessant practice, as well as competition for awards for such products of creative achievement as compositions, public performances, publications, and the like.

4. "deliberately seek out or manage to attract influential mentors" (p. 182), indicating two things: first, the motivation to attract such individuals; and second, that these particularly creative eminent people had the benefit of exposure to mentors like themselves. Thus, Ludwig points out, "future Nobel laureates tend to study under other Nobel laureates" (p. 182), and the like.

Further, Ludwig goes on to say that these individuals “have become servants to their own talent. They constantly seek ways to perfect and express it and construct much of their world around it as well” (p. 182).

MARA interpretation of this feature A: In terms of the key allocation between social and technical calculation, these “Artistic” and “Investigative” individuals are evidently investing heavily in technical calculation. Note that such investments are not required for eminence in political or social spheres, from Ludwig’s analysis. This is a finding that immediately suggests the existence of a disparity with regard to investment in certain kinds of learning between those with high levels of technical intelligence (IQ) versus those with high levels of social intelligence (EQ).

B. The “Right” Kind of Parents

1. “families that provide ‘optimal’ material resources – not too many or too few” (p. 182), specifically excluding families that are either extremely affluent or extremely poor. Note that becoming a politically or socially notable figure may be made more likely by coming from outside the ‘middle classes’. This is fairly obviously the case with individuals from noted families, such as a parent or grandparent who was an elected official or extremely wealthy, which may lead to significant motivation to invest more in social calculation, as such investments may be promptly encouraged or rewarded by those who do so, when they come from the ‘upper classes’. At the other extreme, those who come from overly poor families may not receive the resources or support required to invest sufficiently in the extensive development of their technical skills required for eminence via that route, leaving only the route of developing social intelligence as a viable means of attaining sufficient eminence to be included in Ludwig’s overall sample.

2. “The mothers of the truly great . . often tend to be emotionally disturbed” and “Their fathers, too, also seem to have their share of emotional difficulties” (p. 183) Such parents may have had a heritable lack of social skills, they may have lacked the ability to train their offspring in social maneuvering, or both. Whichever is the case, such families are evidently not going to afford particularly good contexts for developing social intelligence. Note that the obverse is that, from Ludwig’s statistical analysis, families in which both parents are emotionally well-adjusted *do* provide opportunities for developing social intelligence in their offspring.

MARA Interpretation of B: There are some family backgrounds which encourage investment in technical calculation as opposed to social calculation, and such families may provide adequate resources for developing technical intelligence when they are 'middle-class.' Distinctly 'upper-class' families that provide notable opportunities for the use of social and political skills, by contrast, produce fewer children who become technically adept. This suggests that their children instead are more likely to become socially adept.

C. Contrariness

1. "irreverence toward established authority and a readiness to discard prevalent views" (p.184), leading such individuals to make significant new discoveries, develop new kinds of products, and otherwise get ahead of prevailing views. This is a natural manifestation of a pronounced ability to accomplish virtuosic feats of technical calculation, from producing an important scientific breakthrough to developing a new artistic style or idiom.

2. "oppositional in nature," "often at odds with others," and "almost reflexive antagonism" (p. 185); that is, these individuals do not get along in order to go along, or *vice versa.* Evidently, if these individuals have to choose between what they are interested in or believe in or have created, on one hand, and what others find acceptable, on the other, they have a strong bias in favor of the former. In other words, these individuals are not trammeled by convention or audience tastes. Ludwig notes that this went so far as to imperil the physical survival of individuals from his creative group.

3. "a feral outlook in their work, which resists attempts at domestication and social programming" (p. 186). This is counterintuitive, in that in many cases the perceived eminence of those from the creative occupations will depend on pleasing public audiences, grant-review panels, or university personnel committees. Yet the most creative as a group expressly do not behave in a manner which is in their 'careerist' interests. This suggests that they may have little ability to do so.

MARA Interpretation of C: Terms like "contrary," "oppositional," "defiant," and "feral" all suggest that the highly creative group of artists and scientists are in fact deficient in the social skills required to smooth their receipt of professional advancement, rewards, and other material benefits. This indicates a lack of investment in social calculation, in association with high levels of investment in technical calculation. Again, this is strongly supportive of the MARA concept of a trade-off between these two types of calculation in MARA species that have reached a highly polymorphic evolutionary equilibrium.

D. Loners

1. "focusing all their energies on the task at hand" thanks to a "capacity for aloneness or solitude" with a pattern of engaging "in solitary pursuits and don't seek out social affiliations" (p. 186). These individuals are spending significantly less time in social interactions, working instead on producing their creations, of whatever type. And they appear to be happy to do so.

2. "Reluctant to collaborate," "do not work well in groups," and "disinterested in interacting socially with others" (p. 186), these are individuals who are the opposite of "a hale fellow, well met." These individuals are actively resistant to getting involved in social situations, and do not perform particularly gracefully when they do get so involved. In academia, these types are well-known as the extremely productive scholar whom one would never want as Chair of the department.

MARA Interpretation of D: The allocation of resources for calculation, especially time itself, appears to be decisively tilted away from social activities toward non-social or technical activities. And when social activities are engaged in, these individuals are not particularly graceful or diplomatic. This must be seen against the background of the eminent social, business, and political figures who, as a contrasting group in Ludwig's study, statistically spend proportionately less time on creative work as opposed to social interactions.

E. Physical Vulnerability.

1. "sickly and frail, to experience a life-threatening illness, or to have a physical disability" and thus "to have disruptions in their schooling and spend more time at home," "separated from their peers, they tend to develop solitary interests" (p. 187). Interestingly, this would seem to interfere with item A.2, above, concerning extensive training, in that such physical impairment should interfere with opportunities to receive such training in institutional settings like schools, colleges, and the like.

2. *"creatively energized and even motivated"* by their chronic physical ailments (p. 189). This paradoxical effect may arise from a similar effect to that of surgical sterilization on survival in both plants and animals, where reduced physiological investment in reproduction diverts at least some resources toward survival, which is thereby enhanced. Denied normal opportunities for social development, these individuals may instead be focusing on the technical or 'creative' alternatives.

MARA Interpretation of E: Children denied normal opportunities to participate in social life may instead, in effect, switch their cognitive and other resources to the development of their technical intelligence. Thus, their achievements in the non-social sector are enhanced. Note the converse implication: those who are eminent in political, social, and business realms were usually not denied opportunities "to go out into the world" as a result of physical frailty.

F. A Personal Seal

1. *"Whatever they do, their accomplishments have to become specifically identified with them," unlike "people who are good at working in groups, participating in joint projects"* (p. 189). The scientifically and artistically creative are not usually participants in endeavors that require extensive collaboration or cooperation. Instead, they work in such a way that their achievements are specifically associated with them. This suggests that these are people who are specifically *not* good at being team players in endeavors that require faceless, efficient, and collective action.

MARA Interpretation of F: While those who are among the socially or politically eminent in Ludwig's sample can effectively contribute to joint projects for which they will receive little credit, the Artistic and Investigative eminent individuals don't appear to have that facility. Instead, they focus on their idiosyncratic creative pursuits, suggesting a relative trade-off between social and technical intelligences.

G. Drive for Supremacy

1. *"These persons have a drive for dominance, supremacy, preeminence, or power" leading them to "antagonize and alienate," with elements of "arrogance or hubris"* (p. 190). The

interesting part of this attribute is that we can expect that elected office-holders and highly successful business CEOs will have the very same drive for dominance, yet those individuals are specifically less likely to be obvious about this drive, making them less likely to antagonize or alienate those they encounter, from Ludwig's analysis. Here the key point may be that the artistically and scientifically creative are quite poor at disguising their drive. By contrast, social or political leaders are good at this key skill of leadership, according to the statistical results.

2. "self-confidence, while immodest," with there being little ambiguity in quite public declarations of intentions to be "the world's greatest" in whichever creative occupation they pursue (p. 191). Immodest is one of worst things to be perceived as in social or political contexts, and it characteristically leaves the immodest person marked for attack or derision.

3. These individuals are less likely to show "humbleness, humility, self-sacrifice, tactfulness, compassion, sensitivity, and empathy" (p. 192). These individuals are likely to meet DSM criteria for pathological narcissism. Many other people will thus perceive them as 'jerks,' which will impede the success of the creative individual within society as a whole.

MARA Interpretation of G: Even though subtlety, modesty, tact, and dissimulation are among the commonly useful devices of social manipulation and deception, these highly successful creative individuals are singularly deficient in either the ability or the inclination to practice such elementary social tactics, from Ludwig's analysis. This betrays a markedly low level of social intelligence.

H. Psychological "Unease"

1. "inclined to be restless, discontent, impatient, and driven people whose success does not necessarily satisfy them for long," "driven," and "on edge" (p. 192). Ludwig argues that this state of mind or pattern of motivation keeps the creative in a state of psychological unease that is a source of creative productivity.

2. "need to keep their brains active solving problems," such that "Once they seize on these problems, the problems take possession of them and begin to dominate most aspects of their lives" to such an extent that they may "become irritable and short-tempered" when their creative work is not going well (p. 193). In effect, the extremely creative artist or scientist becomes addicted to their work, and suffers cycles of addictive obsession and frustration comparable to those of an individual who abuses substances.

3. "ability to 'turn the power on' in their brains when they are involved in important tasks" and "They are able to work steadily on projects without tiring for extended periods of time" (p. 193). These are people who are able to turn on their creative functions more or less at will, and then sustain such feats of technical processing for long periods. These are individuals for whom creative work is not effortful, but natural and self-sustaining. All three of these points are *in contrast* to the successful politician, military leader, or social figure, for whom such materially, as opposed to socially, creative activity is evidently not driven, self-sustaining, or addictive.

MARA Interpretation of H: The highly creative artists and scientists in Ludwig's 'most eminent' group, by his definition, are individuals who have so heavily and disproportionately invested in non-social types of calculation that functioning in their particular creative realm(s) has taken on the properties of an addiction. For most of them, engaging in social activities may only be sufferable for the purpose of a break from their 'real purpose in life,' the production of scientifically or artistically creative works. As such, they may be as deficient in their social lives as those who are addicted to psychotropic drugs.

The data analysis further shows that the 'lower' quartile of Ludwig's sample, the social and political leaders, are relatively averse to the sustained creative work that is characteristic of the artists and scientists, preferring instead to polish their abilities to lead, inspire, and dominate those around them, all while doing so with the greatest possible charm, tact, and discretion.

Though Ludwig clearly had no intention to provide material for an analysis such as the forgoing, nonetheless his study is the single most useful published compendium of contrasts from the spectrum of allocation of resources, not least of them being time, between social and technical intelligence. His "most eminent" group is evidently made of those who, while generally having significant capacity for the exercise of intelligence and other functional resources, devote very few of them to social functions. His "least eminent" group among those who are all indeed eminent in some way is, by contrast, made up of individuals who are precisely opposite. The "least eminent," that is the socially or politically expert, are not obsessed with creative activity, do not avoid social interactions, and deal with social interactions in a smooth and effective manner.

Note, however, that we are not supposing that some individuals cannot combine both technical and social intelligence in pursuit of their objectives. A film director or the leader of a gigantic technological project may have to combine social and technical intelligence, with a modicum of balance between the two. Ludwig focused on the two extreme quartiles of eminent individuals as defined using his CAS measure, which evidently favored the technically intelligent. This specifically excluded those who were likely to have combined social and technical intelligence in a more balanced blend, individuals who fell into the two intermediate quartiles.

V. Conclusion

We have seen how a hypothesized synergy between social intelligence (EQ) and technical intelligence (IQ) could have been the impetus for the great expansion of brain power during human evolution, despite the fitness side-costs of such big brains. Specifically, armed combat with tools, which combines core aspects of both material and social problem-solving, and thus IQ and EQ in combination, provides a particularly powerful selection mechanism for increased brain sizes. This combination leads to the mental arms race amplifier scenario, which we refer to as the MARA hypothesis, that Rose (e.g. 1980) has long used to explain the explosion in human intelligence across multiple modalities, from conventional IQ *to* other cognitive capacities such as language itself *to* emotional intelligence.

More stereotypic, genetically-encoded, behavioral adaptations in humans, while not in principle excluded by this view, would have been selected against. The improvisational demands of such a mental arms race favor open-ended mental abilities that can be used for novel purposes as changing social and ecological circumstances require. Still physical and biological limitations necessitate a trade-off between the two domains of social and material problem-solving, which in daily life manifests as a continuous spectrum of individual differences with some having greater EQ, some greater IQ, and others in between.

Lastly, evidence from extensive biographical research by Ludwig (1995) highlights how this intertwining of EQ and IQ, and its underlying evolutionary logic, has lifelong consequences for individuals located at different points in the two-dimensional space defined by EQ and IQ axes. Thus, we have a world of socially-hapless scientists and artists, alongside math- and reading-averse empire-builders, with variously adroit intermediate combinations of EQ and IQ that characterize the vast majority of humans.

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References

Bigelow, R.S. (1969) *The Dawn Warriors: Man's Evolution toward Peace*. 1st edn. Boston: Little Brown.

Boesch, C. and Boesch-Achermann, H. (2000) *Chimpanzees of the Taï Forest: Behavioral Ecology and Evolution*. 1st edn. New York: Oxford University Press.

Byrne R. and Whiten A. (1988) *Machiavellian Intelligence: Social Expertise and the Evolution of Intellect in Monkeys, Apes, and Humans*. 1st edn. Oxford, U.K.: Oxford University Press

Darwin, C. (1871) *The Descent of Man, and Selection in Relation to Sex*. 1st edn. London: John Murray.

Ellis, W.S. (1973) Mortality and birth weight in Philadelphia blacks: An example of stabilizing selection. *Amer. Journal of Physical Anthropology,* 38: pp. 145-149.

Engels, F. (1876) 'The part played by labour in the transition from ape to man', later published in *Dialectics of Nature,* which was first assembled in 1883, but not published until 1925.

Estes and Teotónio, H. (2009) 'The experimental study of reverse evolution' in Garland T. and Rose, M.R. (eds.) *Experimental Evolution.* 1st edn. Berkeley, California: University of California Press, pp. 135-172

Goleman, D. (1995) *Emotional Intelligence*. 1st edn. London: Bloomsbury Publishing.

Haigh, J. and Rose, M.R. (1980) 'Evolutionary game auctions." *Journal of Theoretical Biology* 85: pp. 381-397

Humphrey, N.K. (1976) ‘The function of intellect’ in Bateson, P.P.G. and Hinde R.A. (eds.) *Growing Points in Ethology*. 1st edn. Cambridge, U.K.: Cambridge University Press., pp. 303-317.

Hollingworth, L.S. (1942) *Children above 180 IQ Stanford-Binet: Origin and Development.* Yonkers-on-Hudson, New York: World Book Company.

Leonard, W.R. and Robertson, M.L. (1993) Evolutionary perspectives on human nutrition: The influence of brain and body size on diet and metabolism. *Amer. Journal of Human Biology,* 6: pp. 77-88.

Lovejoy, C.O. (1981) ‘The origin of man.’ *Science,* 211: pp. 341-350.

Ludwig, A.M. (1995) *The Price of Greatness*. 1st edn. New York: The Guilford Press.

Maynard Smith, J. (1982) *Evolution and the Theory of Games*. 1st end. Cambridge. U.K.: Cambridge University Press.

McGrew, I.W.C (1987) ‘Tools to get food: the subsistants of Tasmanian Aborigines and Tanzanian chimpanzees compared.’ *J. Anthropol. Res*., 43, pp. 247-58.

McPherron et al (2010) ‘Evidence for stone-tool assisted consumption of animal tissues before 3.39 million years ago at Dikika, Ethiopia.’ *Nature,* 466: pp. 857-860.

Oakley, K. (1959) *Man the Tool-Maker*. Chicago: University of Chicago Press.

Rose, M.R. (1980) ‘The mental arms race amplifier.’ *Human Ecology,* 8: pp. 285-293.

Rose, M.R. (1991) *Evolutionary Biology of Aging*. 1st edn. New York: Oxford University Press.

Rose, M.R. (1998) *Darwin’s Spectre: Evolutionary Biology in the Modern World*. 1st edn. Princeton, N.J.: Princeton University Press.

Simonton, D. (1999) *Origins of Genius: Darwinian Perspectives on Creativity*. 1st edn. New York: Oxford University Press.

Teotónio, H. and Rose, M.R. (2000) 'Variation in the reversibility of evolution.' *Nature,* 408: pp. 436-466.

Wallace, A. (1986) *The Prodigy: A Biography of William James Sidis, America's Greatest Child Prodigy*. New York: E.P. Dutton.

Washburn, S.L. (1960) 'Tools and human evolution.' *Scientific American,* 203: pp. 62-75.

Wood, B. (2005) Human Evolution: A Very Short Introduction. 1st edn. New York: Oxford University Press.

Wynn, T. (1988) 'Tools and the Evolution of Human Intelligence' in Byrne R. & Whiten A. (eds.) Machiavellian Intelligence: Social Expertise and the Evolution of Intellect in Monkeys, Apes, and Humans. 1st edn. Oxford: Oxford University Press, pp. 271-284.

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Philosophy in the Contemporary World: The Philosophy of Food by Henrik Lagerlund

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Very few things are so important to our lives as food, but most of us don't think much about it. Sure, we think about what to eat every day and, even more so, what not to eat, but we don't *really* think about food. Where does it come from? Who produced it? Who picked these tomatoes or apples? How far has it travelled? Even less do we reflect on other more remote issues, but central to food, such as, hunger, population growth, migration, sustainable agriculture, human rights, animal rights, waste, GMOs, etc. It seems clear that we cannot continue to be ignorant of these issues. I suggest we should make them part of our lives and our food choices.

It is becoming clear that our food system involves massive problems that will take all our ingenuity and resolve to come to terms with, and which cannot be solved unless we change our own habits. Most researcher studying this agree that people in certain parts of the world (foremost North America and Europe) need to eat less and food production overall needs to increase in order to feed a growing world population. But, how do we increase food production without further destroying an already fragile world? At the moment there is no good answer which does not involve major changes to the way we produce food. Things will only improve if more of us start to seriously think about food, develop a better understanding of the food system, and change our behavior accordingly. We need a practical approach and it is as part of such an approach that I would like to introduce a philosophy of food.

What is a philosophy of food? Of course, this could mean different things to different people. The way I understand it is not as an ethics, but as a way of life. In this, I take my inspiration from the Ancient Greek philosopher Socrates. To understand what Socrates meant by philosophy one should look to Plato's famous dialogue the *Apology*. Most philosophers know the story, but I will rehearse it here for the sake of clarity. Plato's book is about the trial of Socrates. Socrates had been accused by the Athenian government of seducing the young and leading them astray.

As part of his defense, he outlines what philosophy is, according to him, and its relation to practical life. It includes primarily four things: intellectual modesty, questioning habits, a devotion to truth, and a belief in reason.

The Oracle of Delphi had claimed that no one in Greece was wiser than Socrates. He himself denied this, but said that there was one thing, a kind of wisdom perhaps, that he had that most others did not, namely, an awareness of his own ignorance. The slogan that Plato uses to express Socrates's intellectual modesty was that the only thing that he knew was that he did not know anything.

We are also supposed to question our habits, according to this philosophy. The goal of the Socratic dialogues, of this kind of interrogative investigation, is to achieve genuine self-knowledge. This is done by taking apart the things that one thinks one knows and expose illusions about reality as well as misconceptions about one's own state of mind.

What about his devotion to truth? Socrates states famously that "the unexamined life is not worth living". In the *Apology*, Socrates is sentenced to death, but is offered a chance to repent. Instead, he prefers to die rather than give up philosophy. He is devoted to the pursuit of truth in all matters.

His belief in reason is as strong as his devotion to truth. Even though the world around him has gone crazy and he is confronted with death, he refuses to give up on the power of reason. He presents a powerful defense of rationality and reason.

Plato's portrait of Socrates and the view of philosophy he develops became a model for all future philosophy. We are seldom presented with such choices, at least not in this part of the world; philosophy (thoughts/ideals) or death, but all of us are daily faced with opportunities to decide between what is convenient, and conventional, and our devotion to truth and reason. Those are the choices that determine whether we deserve to call our lives philosophical.

This is what I put into the philosophy of food, a commitment to an examined life in relation to our daily food choices. To be a philosophical foodie, as I like to call it, is to examine one's own habits and decide to lead a life that upholds certain global values. Living this way would change not only one's own life but the world as well. For me, it means saying no to many things that are convenient and seeking alternatives that, for example, do not promote human rights violations, contribute to injustice and leads to a sustainable world that we can pass on to our children with good conscience.

Why should we do this? Ultimately, because we are human. As humans, we always use values and our beliefs about the world to make choices and guide our actions. Ask yourself what kind of person you want to be and what kind of world you want to live in. Becoming a philosophical foodie is about asking these questions and allowing them to inform your choices. Now, I am not a fanatic, which perhaps Socrates was, and I realize that truth and reason need to be balanced. We cannot live up to our ideals. If we try, we will always fail, and as a result we will be very unhappy. Finding the right balance between living an examined life and the life you can live given your own real possibilities is part of the philosophy of food. But we must always examine our life using reason, and strive to know ourselves better as well as do better.

The philosophy of food is obviously about food in all its aspects, but at the heart of it is a way of life. I believe we all need to face up to an alternative way of life in order for our world to remain a place where we will want to live and flourish.

How would it affect your life to become a philosophical foodie? Firstly, you would need to examine your own values. What matters to you in your choice of food? Is it taste? Is it price? Is it health? It is convenience? Is it some moral value, like animal rights or human rights? Do you eat local food? Does it matter to you where your food is produced? And, ultimately, are you happy with how you live your life?

Inquire about food. Be curious. Philosophy, as Socrates thought about it, is about asking questions. Where does your food come from? How far has it traveled to get to your plate? You'd be surprised how little most people know about the production or distribution of what we eat. Remember intellectual modesty. Do not assume you know best. For example, just because you and your family have done something for a long time does not mean it is the best way or right way to do things. Attempt to broaden your value system and you might be surprised how this will change your habits and your choices. In the long run, it might also make you happier. It will make your life more philosophical.

I will here touch upon two things that are particularly close to my heart and that I strive to incorporate in my food choices – two things that for me are implied in being a philosophical foodie.

It might surprise some people to know that food is now cheaper than it has ever been in the history of the world. On average, we spend a little more than 10% (9% on food at home and an additional 4-5% on food in restaurants) of our income on food in North America (a little less in the US than in Canada and a little more in Europe). Have you ever asked yourself why food is so cheap? Obviously, we have over the years industrialized the food system to be able to press down the cost of production. About 10 giant companies control the food chain and family farms are almost gone. One way we have managed to push down the costs of food is by paying very low wages to farm works, like pickers. These food companies put enormous pressure on farmers. Much of our cheap food rests on the backs of extraordinary exploitation of workers and is sometimes even reliant on slave labor. Fish from Thailand and other parts of Asia might come from boats that seldom come to port and use slave labor, but closer to home we have an enormous dependence on immigrant labor in California and Florida. Many of our fruits and vegetables come from these places, where workers get very little pay and work under harsh and unsafe conditions. Canada has a seasonal or migrant workers program that has been running for decades, virtually unchanged. Almost all of them work in the food system. They come from mostly Central and South America and travel far, leaving their families, to work for very little and under unsafe conditions. They even have to pay EI (Employment Insurance), but they are forbidden to benefit from the program. Fancy that! Thankfully, the present government is reviewing the program. The problem is that without these workers we would not enjoy such cheap food or perhaps food at all. We have grown dependent on this exploitation.

These are what I call violations of human rights in the food system. As philosophical foodies, we need to reflect on whether this is acceptable and what we can do to avoid eating food produced or picked by humans working under such conditions. How do we do that? One way is to try to eat food that you know is not produced under such circumstances. What kind of food is that? Join a CSA (Community Supported Agriculture), get to know your farmer through farmers markets etc. There are ways, but in the end we need to change the existing food system and pay everybody working in it decent salaries. As a philosophical foodie you can work on various levels to strive for such a change.

This is even more important in relation to another other issue that I want to mention here: sustainability.

In 2050, Earth is predicted to be the home of more than 9 billion people. To feed all these people the United Nations estimates that we need to double our food production. This is an enormous challenge for the food system in the coming decades. It is hard to see how we can do this without changing something substantial about how we produce our food and what we eat. Just to mention one example. Most of our protein now comes from meat (beef, pork and chicken). Something like 60 billion farm animals are slaughtered every year and we are going towards 120 billion. The implications of this large meat consumption are vast. Think about the increased production of corn to feed all these animals, the increased use of oil to produce that food (driving the tractors), the increased problem of housing all these animals, worry about avian flu, increased use of antibiotics, the unusable bio-waste from all these animals, etc. Not to mention the increased methane production contributing to global warming (the keeping of livestock is responsible for releasing more green-house gases into the atmosphere than the whole transportation sector). All this is just not sustainable. There are many well-known problems that will face us in the very near future. I think this is together with climate change the most difficult problem facing humanity. How do we find a new and sustainable way to produce food?

As philosophical foodies, we need to adjust our attitudes to what we eat to accommodate this. We need to think about alternative ways of getting protein. Fish has its own problems and will not likely be able to replace meat. Some scientists advocate for bugs. I am sure we will see bug-hot dogs soon.

Many people look to science to solve our problems. GMO’s (Genetically Modified Organism) will become more and more common, but they have problems as well and as a philosophical foodie we need to pay attention to this debate. What are the arguments for GMO’s? Are they safe? We already have a GMO salmon approved in Canada and there are GMO apples coming. Cultured meat, that is, meat grown in a lab, is close to becoming generally available.

By making global values like human rights and sustainability our own, we will be able to think about our food choices in a new way. We can all contribute to making our world a little bit better. Incorporating these values into our choices and into our lives will change our lives significantly, but the first step is to become more reflective about food, our own values and choices, that is, to make our live philosophical. This is one way philosophy can change the world.

Original Source: Lagerlund, H. (2017, December 7). *Philosophy in the Contemporary World: The Philosophy of Food*. Blog of the APA. Retrieved from https://blog.apaonline.org/2017/12/07/philosophy-in-the-contemporary-world-the-philosophy-of-food/.

Saving a Child by Peter Singer

Prof. Peter Singer (Princeton University)

On your way to work, you pass a small pond. On hot days, children sometimes play in the pond, which is only about knee-deep. The weather's cool today, though, and the hour is early, so you are surprised to see a child splashing about in the pond. As you get closer, you see that it is a very young child, just a toddler, who is flailing about, unable to stay upright or walk out of the pond. You look for the parents or babysitter, but there is no one else around. The child is unable to keep her head above the water for more than a few seconds at a time. If you don't wade in and pull her out, she seems likely to drown. Wading in is easy and safe, but you will ruin the new shoes you bought only a few days ago, and get your suit wet and muddy. By the time you hand the child over to someone responsible for her, and change your clothes, you'll be late for work. What should you do?

I teach a course called Practical Ethics. When we start talking about global poverty, I ask my students what they think a person should do in this situation. Predictably, they respond that you should save the child. "What about your shoes? And being late for work?" I ask them. They brush that aside. How could anyone consider a pair of shoes, or missing an hour or two at work, a good reason for not saving a child's life?

I first told the story of the drowning child in the shallow pond in "Famine, Affluence and Morality," one of my first articles, originally published in 1972, but still widely used in courses in ethics. In 2011, something resembling this hypothetical situation occurred in Foshan, a city in southern China. A 2-year-old girl named Wang Yue wandered away from her mother and into a small street, where she was hit by a van that did not stop. A CCTV camera captured the incident. But what followed was even more shocking. As Wang Yue lay bleeding in the street, 18 people walked or rode their bikes right past her, without stopping to help. In most cases, the camera showed clearly that they saw her, but then averted their gaze as they passed by. A second van ran over her leg before a street cleaner raised the alarm. Wang Yue was rushed to hospital, but sadly, it was too late. She died.[1]

If you're like most people, you are probably saying to yourself right now: "I wouldn't have walked past that child. I would have stopped to help." Perhaps you would have; but remember that, as we have already seen, 5.4 million children under 5 years old died in 2017, with a majority of those deaths being from preventable or treatable causes. Here is just one case, described by a man in Ghana to a researcher from the World Bank:

Take the death of this small boy this morning, for example. The boy died of measles. We all know he could have been cured at the hospital. But the parents had no money and so the boy died a slow and painful death, not of measles but out of
poverty.[2]

Think about something like that happening hundreds of times every day. Some children die because they don't have enough to eat. More die from measles, malaria and diarrhea—conditions that either don't exist in developed nations or, if they do, are almost never fatal. The children are vulnerable to these diseases because they have no safe drinking water or no sanitation, and because when they do fall ill, their parents can't afford any medical treatment or may not even be aware that treatment is needed. Oxfam, Against Malaria Foundation, Evidence Action, and many other organizations are working to reduce poverty, or provide mosquito nets or safe drinking water. These efforts are reducing the toll. If these organizations had more money, they could do even more, and more lives would be saved.

Now think about your own situation. By donating a relatively small amount of money, you could save a child's life. Maybe it would take more than the amount needed to buy a pair of shoes, but we all spend money on things we don't really need, whether on drinks, meals out, clothing, movies, concerts, vacations, new cars, or house renovations. Is it possible that by choosing to spend your money on such things rather than contributing to an effective charity, you are leaving a child to die, a child you could have saved?

I. Poverty Today

Before we get further into why we all ought to be doing more for people in extreme poverty, please find something you can write with and answer the following questions:

1. In the last 20 years, the proportion of the world's population living in extreme poverty has ... a) Almost doubled b) Remained the same c) Almost halved 2. How many of the world's 1-year-old children today have been vaccinated against some disease?

a) 20% b) 50% c) 80% 3. Where does the majority of the world's population live?

a) Low-income countries b) Middle-income countries c) High-income countries

So that you won't see the correct answers before you have written yours down, we have put them in a box below.

The correct answers are:

1 c) Almost halved,
2 c) 80%,
3 b) Middle income countries

How did you do?

Over recent decades, the late Hans Rosling and The Gapminder Foundation have posed these and similar questions to thousands of people around the world as part of the Gapminder Misconception Study.[3] In *Factfulness*, Hans, his son Ola Rosling, and his daughter-in-law Anna Rosling Rönnlund share the surprising results of the tests. Here is a summary of some of the key findings.

According to the World Bank, the proportion of the world's population living below the Bank's extreme poverty line fell from 34% in 1993 to 10.7% in 2013. This suggests that it fell by two-thirds, rather than just half, but because extreme poverty is very difficult to measure, the study used a conservative answer. In any case, this dramatic reduction is one of the greatest achievements in the history of our species; yet few people know about it. On average, only 7% got question one right. In the United States the figure is even lower: 19 out of every 20 Americans who took the survey in the United States believed, falsely, either that the proportion of people in extreme poverty rate had not changed over the last 20 years, or that it had greatly increased.
The result is similar for question two, about vaccines. Almost all children are vaccinated in the world today, a phenomenon that the authors of *Factfulness* rightly label "amazing." Again, very few people—only 13%—were aware of this important success in protecting the health of children all over the world.

By now you can probably guess that most people also get the third question from the Gapminder Misconception Study wrong. We have become used to dividing the world up into "developed" and "developing" countries, which leaves no space for the "middle-income" countries in which three-quarters of the world's population lives. If we add to that people living in high-income countries, we reach 91%. That leaves only 9% living in low-income countries, and of course, not all of them are in extreme poverty, but that is no ground for complacency, because large middle- income countries such as India and Nigeria have very unequal distributions of income, with many millions of people living in extreme poverty.

As we shall see in Chapter 3, many people don't give to charities that seek to reduce extreme poverty because they believe that it is a hopeless task and that we are making no progress. This is why it is vital that more people learn about the impressive progress indicated by the answers to these questions. It is also essential that we listen to the people living in extreme poverty, and find out what they are experiencing, and what they would like to change. A few years ago, the World Bank asked researchers to do just that. They were able to document the experiences of 60,000 women and men in 73 countries. Over and over, in different languages and on different continents, poor people said what poverty meant to them, and what poverty prevented them from doing:

You are short of food for all or part of the year, often eating only one meal per day, sometimes having to choose between stilling your child's hunger or your own, and sometimes being able to do neither. You can't save money. If a family member falls ill and you need money to see a doctor, or if the crop fails and you have nothing to eat, you have to borrow from a local moneylender and he will charge you so much interest as the debt continues to mount that you may never be free of it. You can't afford to send your children to school, or if they do start school, you have to take them out again if the harvest is poor. You live in an unstable house, made with mud or thatch, that you need to rebuild every two or three years or after severe weather. You have no nearby source of safe drinking water. You have to carry your water a long way, and even then, it can make you ill unless you boil it.

But extreme poverty is not only a condition of unsatisfied material needs. It is often accompanied by a degrading state of powerlessness. Even in countries that are democracies and are relatively well-governed, respondents to the World Bank survey described a range of situations in which they had to accept humiliation without protest. If someone takes what little you have, and you complain to the police, they may not listen to you. Nor will the law necessarily protect you from rape or sexual harassment. You have a pervading sense of shame and failure because you cannot provide for your children. Poverty traps you, and you lose hope of ever escaping from a life of hard work for which, at the end, you will have nothing to show beyond bare survival.[4]

The World Bank defines extreme poverty as not having enough income to meet the most basic human needs for adequate food, water, shelter, clothing, sanitation, health care, and education. Between 1990 and 2015, more than a billion people lifted themselves out of extreme poverty. As a result, it can reasonably be claimed that the global poverty rate is now lower than it has ever been in recorded history. Nevertheless, according to the most recently available data, 736 million still live on less than $1.90 a day—the global extreme poverty line set by The World Bank.[5]

In response to the “$1.90 a day” figure for determining who is in extreme poverty, the thought may cross your mind that in many low-income countries, it is possible to live much more cheaply than in richer nations. Perhaps you have even done it yourself, backpacking around the world, living on less than you would have believed possible. So you may imagine that this level of poverty is less extreme than it would be if you had to live on that amount of money in, for example, the United States, France, or Spain. If such thoughts did occur to you, you should banish them now, because the World Bank has already made the adjustment in purchasing power: its figures refer to the number of people existing on a daily total consumption of goods and services—whether earned or home-grown—comparable to the amount of goods and services that can be bought in the United States for $1.90.

In wealthy societies, most poverty is relative. People feel poor because many of the good things they see advertised on television are beyond their budget—but they do have a television. In the United States, 97% of those classified by the Census Bureau as poor own a color TV. Three quarters of them own a car. Three quarters of them have air conditioning.[6] I am not quoting these figures in order to deny that the poor in the United States face genuine difficulties. Nevertheless, for most, these difficulties are of a different order from those of the world’s poorest people. The 736 million people living in extreme poverty are poor by an absolute standard tied to the most basic human needs. They are likely to be hungry for at least part of each year. Even if they can get enough food to fill their stomachs, they will probably be malnourished because their diet lacks essential nutrients. In children, malnutrition stunts growth and can cause permanent brain damage. The poor may not be able to afford to send their children to school. Even basic and life-saving health care services are usually beyond their means.

This kind of poverty kills. While a child born in Spain today can expect to live beyond 83 years, children born in countries such as Sierra Leone, Nigeria, and Chad have a life expectancy of less than 55 years.[7] Sub-Saharan Africa continues to be the region with the highest under-five mortality rate in the world: one child in 13 dies before his or her fifth birthday, a ratio 20 times higher than the 1 in 263 mortality rate in Australia and New Zealand.[8] And to the UNICEF figure of 5.4 million young children dying every year, largely from preventable, poverty-related causes, we must add millions of older children and adults. All told, this means tens of thousands are dying each day. These are people who do not have to die: they could be saved, often by simple, inexpensive means.

When I wrote the first edition of this book, South Asia had long been the region with the largest number of people living in extreme poverty, and India had more extremely poor people than any other country. In just a decade, however, all that has changed. Economic growth has reduced the number of South Asians living in extreme poverty from half a billion in 1990 to 216.4 million in 2015. At that time, India was still the single country with the greatest number of people living in extreme poverty: 176 million, almost a quarter of the global extreme poor. That number was projected to continue to decline quite rapidly, however, and on some estimates, by 2019, there were more Nigerians than Indians in extreme poverty.[9]

The most dramatic reduction in poverty has been in East Asia and the Pacific, where the extreme poverty rate has dropped astoundingly, from 60% in 1990[10] to only 2.3% in 2015 (although there are still nearly 10 million extremely poor Chinese, and smaller numbers elsewhere in the region).
The World Bank's 2018 report on poverty contained good news and bad news. The good news was that over the 25 years from 1990 to 2015, the percentage of the world's population living in extreme poverty dropped by an average of one point per year, from nearly 36% to 10%. The bad news was that this trend has slowed, with the rate dropping by only one percentage point between 2013 to 2015. The reason for the slowdown is that progress in reducing poverty is slower in sub-Saharan Africa, the region where most of the world's extremely poor people now live, than in Asia. Sub-Saharan Africa is also the region with the highest proportion of people living in extreme poverty—about 4 in every 10 people. The World Bank reports that "extreme poverty is increasingly becoming a Sub-Saharan African problem" and observes that "Of the world's 28 poorest

countries, 27 are in Sub- Saharan Africa, all with poverty rates above 30 percent." The Brookings Institution, an American research institute, adds that "By 2023, Africa's share will rise to over 80 percent (up from 60 in 2016). For Africa to end poverty by 2030, more than one person would need to escape poverty every second; instead, Africa currently adds poor people."[11]

II. Affluence Today

In September 2018, for the first time in the history of our species, more than half of all humans alive were middle-class or above, if we use that term to mean that they had enough income to do things like go to the movies, take vacations, buy consumer items like washing machines, or last through a period of illness or unemployment without becoming poor.[12]

Today, therefore, there are about 3.8 billion people living at a level of affluence never previously known except in the courts of kings and nobles. Louis XIV, France's "Sun King," could afford to build Versailles, the most magnificent palace Europe had ever seen, but he could not keep it cool in summer as effectively as most people in high-income nations can keep their homes cool today. His gardeners, for all their skill, were unable to produce the variety of fresh fruits and vegetables that we can buy all year- round. If he developed a toothache or fell ill, the best his dentists and doctors could do for him would make us shudder.

We're not just better off than a French king who lived centuries ago. We are also much better off than our own great- grandparents. For a start, we can expect to live about 30 years longer. A century ago, 1 child in 10 died in infancy. Now, in most rich nations, that figure is less than 1 in 200.[13] Another telling indicator of how wealthy we are today is the modest number of hours we must work in order to meet our basic needs. Today Americans spend, on average, only 6.4% of their income on buying food.[14] If they work a 40-hour week, it takes them barely two hours to earn enough to feed themselves for the week. That leaves far more to spend on consumer goods, entertainment, and vacations.

And then we have the super-rich—people who spend their money on palatial homes, ridiculously large and luxurious boats, and private planes. In 2019, Forbes calculated that there were 2,153 billionaires in the world—nearly double as many as there were ten years ago—and they keep getting richer, widening the gap between themselves and ordinary wage earners.[15] To cater to such well-to-do people, in December 2018 Boeing Business Jets launched the BBJ 777X, a new

Boeing Business Jet model based on the Boeing 777 that can fly more than halfway around the world without stopping. The price? $450 million for a "green" aircraft—and no, that doesn't mean one that has zero carbon emissions: it means the plane without the interior fitting. Adding the interior, which is designed to the customer's specifications, will cost another $25–$50 million. In commercial service, this plane will seat 365 passengers. The private version might carry 35.[16] Price aside, owning a really big airplane carrying a small number of people is a sure way to maximize your personal contribution to global warming. But for conspicuous waste of money and resources it is hard to beat a luxury yacht. As *Business Insider* reported in 2017, "It has become normal for the world's wealthiest individuals to drop millions, even billions, on lavish superyachts." Billionaires compete to be the owner of the largest private yacht—a title held at the moment by Sheikh Khalifa bin Zayed Al Nahyan, the Emir of Abu Dhabi and owner of *Azzam*, which at 180 meters long, edged out the previous largest, *Eclipse*, owned by the Russian billionaire Roman Abramovich. *Azzam* is estimated to have cost $400 million. It has accommodation for 36 guests. These superyachts are also highly polluting, because they use huge amounts of diesel fuel. *Azzam's* tanks hold a million liters of fuel—or 20,000 times as much as a typical small car, and more than five times as much as a commercial airliner.[17]

While I was working on the first edition of this book, a special advertising supplement fell out of my Sunday edition of *The New York Times*: a 68-page glossy magazine filled with advertising for watches by Rolex, Patek Philippe, Breitling, and other luxury brands. The ads didn't carry price tags, but a puff piece about the revival of the mechanical watch gave guidance about the lower end of the range. After admitting that inexpensive quartz watches are extremely accurate and functional, the article opined that there is "something engaging about a mechanical movement." Right, but how much will it cost you to have this engaging something on your wrist? "You might think that getting into mechanical watches is an expensive proposition, but there are plenty of choices in the $500–$5,000 range." Admittedly, "these opening-price-point models are pretty simple: basic movement, basic time display, simple decoration and so on." From which we can gather that most of the watches advertised are priced upward of $5,000, or 100 times what anyone needs to pay for a reliable, accurate quartz watch. That there is a market for such products— and one worth advertising at such expense to the wide readership of *The New York Times*—is another indication of the affluence of our society.[18]

If you're shaking your head at the excesses of the super-rich, though, don't shake too hard. Think again about some of the ways Americans with average incomes spend their money. In most places in the United States, you can get your recommended eight glasses of water a day out of the tap for less than a penny. Yet millions of people regularly opt for store-bought, where a typical bottle of water costs about $1.50 and some brands such as Fiji— imported all the way from the Fiji Islands—will set you back $2.25 or more. And in spite of the environmental concerns raised by the waste of energy that goes into producing and transporting bottled water, Americans are buying more and more of it, boosting the total to 13.7 billion gallons in 2017.[19] Think, too, of the way many of us get our caffeine fix: you can make coffee at home for pennies rather than spending four dollars or more on a latte. Or have you ever casually said "yes" to a waiter's prompt to order a second soda or glass of wine that you didn't even finish? When Dr. Timothy Jones, an archaeologist, led a U.S. government–funded study of food waste, he found that 14% of household garbage is perfectly good food that was in its original packaging and not out of date. More than half of this food was dry-packaged or canned goods that keep for a long time.

Americans waste, according to the U.S. Department of Agriculture, 30–40% of their food supply, or about $161 billion worth of food.[20] People also buy an astonishing amount of clothing that they never wear—£200 worth on average per person in the United Kingdom according to one survey; while in the United States, fashion designer Deborah Lindquist claims that the average woman owns more than $600 worth of clothing that she has not worn in the last year.[21] Whatever the actual figure may be, it is fair to say that almost all of us, men and women alike, buy things we don't need, some of which we never even use.

Most of us are absolutely certain that we wouldn't hesitate to save a drowning child, and that we would do it at considerable cost to ourselves. Yet while thousands of children die each day, we spend money on things we take for granted and would hardly notice if they were not there. Is that wrong? If so, how far does our obligation to the poor go?

Endnotes

1. Malcolm Moore, "As Chinese Hit-and-run Girl Dies, Passersby Claim They Did Not See Her," *The Telegraph*, October 21, 2011, https://www.telegraph.co.uk/news/worldnews/asia/china/8841840/Chinese-hit-and-run-girl-dies-passersby-claimthey-did-not-see-her.html.

2. Deepa Narayan with Raj Patel, Kai Schafft, Anne Rademacher, and Sarah Koch-Schulte, *Voices of the Poor: Can Anyone Hear Us?* Published for the World Bank by Oxford University Press (New York, 2000), p. 36.

3. More about the Misconception Study can be found at: gapm.io/gms.

4. Narayan et al., *Voices of the Poor*, p. 28.

5. World Bank Press Release, "Decline of Global Extreme Poverty Continues but Has Slowed: World Bank," September 19, 2018, http://www.worldbank.org/en/news/pressrelease/2018/09/19/decline-of-global-extremepoverty-continues-but-has-slowed-world-bank.

6. Robert Rector and Kirk Johnson, "Understanding Poverty in America," Heritage Foundation, January 5, 2004, https://www.heritage.org/welfare/report/understandingpoverty-america; Rector and Johnson draw on data available from the 2003 U.S. Census Bureau report.

7. "Human Development Reports, 2018 Statistical Update," United Nations Development Programme, http://hdr.undp.org/en/2018-update.

8. "Levels & Trends in Child Mortality Report 2018," UNICEF, https://data.unicef.org/wpcontent/uploads/2018/10/Child-Mortality-Report-2018.pdf.

9. Hartwig Schafer, "Finishing the Job of Ending Poverty in South Asia," The World Bank, October 17, 2018, https://blogs.worldbank.org/endpovertyinsouthasia/finishingjob-ending-poverty-south-asia.

10. "No Poverty," World Bank, accessed April 7, 2019, http://datatopics.worldbank.org/sdgatlas/archive/2017/SDG-01-no-poverty.html.

11. Homi Kharas, Kristofer Hamel, and Martin Hofer, "Rethinking Global Poverty Reduction in 2019," Brookings Institute,

https://www.brookings.edu/blog/futuredevelopment/2018/12/13/rethinking-globalpoverty-reduction-in-2019/.

12. Homy Kharas and Kristofer Hamel, "A Global Tipping Point: Half the World Is Now Middle Class or Wealthier", September 27, 2018, Brookings Institute, https://www.brookings.edu/blog/futuredevelopment/2018/09/27/a-global-tipping-pointhalf-the-world-is-now-middle-class-or-wealthier/.

13. James Riley, *Rising Life Expectancy: A Global History* (New York: Cambridge University Press, 2001); Jeremy Laurance, "Thirty Years: Difference in Life Expectancy between the World's Rich and Poor Peoples," *The Independent* (U.K.), September 7, 2007, https://www.independent.co.uk/lifestyle/health-and-families/health-news/thirtyyears-difference-in-life-expectancy-between-theworlds-rich-and-poor-peoples-401623.html.

14. Alex Gray, "Which Countries Spend the Most on Food?" *World Economic Forum*, December 7, 2016, https://www.weforum.org/agenda/2016/12/thismap-shows-how-much-each-country-spends-onfood/.

15. Luisa Kroll and Kerry A. Dolan, "Billionaires," *Forbes*, March 5, 2019, https://www.forbes.com/billionaires/#73562421251c.

16. Kate Sarsfield, "Boeing Business Jets Confident on 777x prospects," *FlightGlobal*, December 11, 2018, https://www.flightglobal.com/news/articles/boeingbusiness-jets-confident-on-777x-prospects-454284/; Boeing Press Release "Boeing Launches Longest-Range Business Jet Ever with BBJ 777X," December 10, 2018; Matt Taylor, "Boeing BBJ 747-8: Buyer's and Investor's Guide," *Corporate Jet Investor*, April 27, 2018, https://corporatejetinvestor.com/articles/boeingbbj-747-8-buyers-and-investors-guide-748/.

17. Danielle Muoio, "The 11 Most Expensive Yachts in the World," *Business Insider*, June 12, 2017, https://www.businessinsider.com/mostexpensive-yachts-in-the-world-2017-6; SuperYacht Fan, "All You Need to Know About the Emir of AbuDhabi and His Yacht Azzam," https://www.superyachtfan.com/superyacht_azzam.html; Luke Wheeler, "How Much Fuel Does It Take to Fill the World's Largest Superyacht?" *Yachting Pages Media Group*, July 27, 2018,

https://www.yachting-pages.com/content/howmuch-fuel-does-it-take-to-fill-a-superyachtguide.html.

18. "Watch Your Time," Special Advertising Supplement to *The New York Times*, October 14, 2007. The passage quoted is on p. 40.

19. Rachel Arthur, "Bottled Water Takes Top Spot in US," *Beverage Daily.com*, June 1, 2018, https://www.beveragedaily.com/Article/2018/06/01/Bottledwater-takes-top-spot-in-US-in-2017.

20. Lance Gay, "Food Waste Costing Economy $100 Billion, Study Finds," *Scripps Howard News Service*, August 10, 2005, http://www.sitnews.us/0805news/081005/081005_shns_garbage.United States Department of Agriculture, Office of the Chief Economist, OCE Home, U.S. Food Waste Challenge, FAQ's, https://www.usda.gov/oce/foodwaste/faqs.htm.

21. Lucy Mangan, "Why Are Our Wardrobes Full of Unworn Clothes? Because Most Purchases Are Not Rational," *The Guardian*, January 2, 2018, https://www.theguardian.com/fashion/shortcuts/2018/jan/02/unworn-clothes-worth-10-billion-pounds; Deborah Lindquist, "How to Look Good Naked," Lifetime Network, Season 2, Episode 2, July 29, 2009. As relayed by Courtney Moran.

Original Source: Singer, P. (2009, March). The Life You Can Save: Saving a Child. Penguin Random House LLC.

An Interview with Emeritus Professor James Robert Flynn, FRSNZ on Intelligence Research, Evolutionary Biology, and IQ Gains and Advanced Moral Views (Part One) by Scott Jacobsen

Scott Douglas Jacobsen

Abstract: Dr. James Robert Flynn, FRSNZ is an Emeritus Professor of Political Studies at the University of Otago in Dunedin, New Zealand. He discusses: current intelligence research; evolutionary biology; and the correlation between IQ gains and the advanced moral views.

KEYWORDS: evolutionary biology, intelligence, IQ, James Flynn, morals, political studies.

1. Scott Douglas Jacobsen: Let us start from the current empirics of intelligence research. What are the overall findings now? What is the consensus of the field, if there is one?

Professor James Flynn: One of the consensuses of the field is one that I will not explore, that is, the relationship of intelligence to brain physiology. People seem to be inventing all sorts of wonderful new tools to investigate the brain beyond magnetic resonance imaging and see what type of thought processes are going on, and that should be extremely illuminating.

Obviously, cognition has a physiological basis. If we have illusions as to just what the physiological basis of certain cognitive abilities are, they certainly need correcting.
As to other areas of research, many people are not sufficiently sophisticated about the phenomenon of IQ gains over time. They do not seem to entirely grasp its significance and its limitations.

For example, the fact that people are better at generalization often produces a rise in moral reasoning. If you talked to my grandfather about race, he had certain fixed racial mores. But if you take a young person today, they are more flexible. If you ask, “Should you be underprivileged because your skin is black?”, and then ask, “What if your skin turned black?”, they would see the point. You must render your moral principles logically consistent.

They would not do what my father would do. He would say, “That is the stupidest thing I have ever heard of. Who do you know whose skin turned black?” He would not take a hypothetical seriously, or the demands it entails for logical consistency. And once you concede that sheer “blackness” does not count, you would have to list personal traits that made someone worthy of persecution. That immediately gets you down to individuals as individuals, not individuals as a member of a particular race.

In my lifetime; students are less subject to racist and sexist stereotypes. That has had a good deal to do with the nature of the IQ gains over time, our ability to take hypothetical situations seriously, our ability to generalize and to see moral maxims as things that ought to have some type of universal applicability, rather than be just a tribal inheritance.

2. Jacobsen: Does a modern understanding of evolutionary biology help with this?

Flynn: They do not need anything as sophisticated as that. However, in saying that people today are better at moral assessments, I may give a false impression. Because they do need basic knowledge about the world and its history. You can have a very enlightened point of view towards social justice, and you can be free of racial stereotypes and yet, you can be colossally ignorant. All recent studies show that Americans are reading less and are less aware of how nations and their histories differ.

I emphasize this point in several of my books such as *The Torchlight List* and *More Torchlight Books.* People are surrounded by the babble of the media, *Fox News* and even *CBS News*. They are surrounded by the rhetoric of politicians. When people reach false conclusions about what ought to be done, it is often just sheer lack of the background knowledge that will allow them to put their egalitarian ideals to work.

Remember how America was talked into going into Iraq. This was not to wreak devastation on Iraqis, it was going to help Iraqis. This was going to give them a modern, stable society. Put that way, it sounds very good, does it not?

All people would have had to do would have been to have read one book on the Middle East, like Robert Fisk’s *The Great War for Western Civilisation*. They would have found that no

Western power that sent troops into the Middle East has had a credit balance. They have always managed to get more people killed than would have been killed otherwise, and when they left, they left behind nations that had to "nation build" themselves, like every other nation in history.

I have often used an example that any properly educated person would think of immediately. That is The Thirty Years' War in Germany (1618-1648), between Catholic and Protestant. It killed off half of the population. Let us imagine that a Turkish sultan, who in 1618, looked at Germany and said, "Look at how these Catholics and Protestants are torturing each other. Surely if I go in with a Turkish army, I can punish the wicked ones who do the most drawing and quartering, and I can reward the people who are more tolerant, and I will teach Catholic and Protestant to live to together in a nation-built Germany."

We can all see the absurdity of this. But we can't see the absurdity of a "benevolent" America sending an army into the Middle East to punish the bad guys and help the good guys, and make Sunnis and Shias love one another and nation build together.

The Thirty Years' war also teaches us a lesson about Israel's policy in the Middle East. What was Cardinal Richelieu's policy from1618 to 1648? He said, "I am a Frenchman first, and a Catholic second. What I am going to do is meddle in this war and whoever is losing, I will back. I want these wars to go on forever. The more dead Germans, Catholic or Protestant, the better for France."

This foreshadows Israel's stand about the wars that rage in the Middle East. Israel believes that the Arabs will never accept them. It will always have to be stronger than the Arab nations to defend itself, and the weaker and the more divided the Arabs the better. This, of course, has nothing to do with the interests of American foreign policy. America must be talked into creating chaos in the Middle East so as "to do good".

America is going through a trauma now. We backed Saudi Arabia against Iran, and now it turns out that Saudi Arabia is at least as wicked as Iran, killing people by the millions in Yemen. It still lops people's hands off for theft. The women who pioneered against the restrictions on driving are all in jail. Until recently the Shiite population could not have cellars because they were suspected of conducting filthy rites down there.

Americans do not know enough to assess either US or Israeli policy. The average person's "knowledge" is limited to what they are told. They may be well-meaning. But they are told that Saddam Hussein is a tyrant. They meet exiles who dress like Westerners and look like themselves. These exiles use the language of democracy and free speech. However, their real goal is to get back into power in Iraq and their only hope of that is American intervention. Academics are fixated on whether the 21st Century will see IQ gains or IQ losses. The real question for the 21st century is whether we can produce a better-educated population. The odds seem to be all against it.

I have a book coming out this year called *In Defense of Free Speech: The University as Censor*. More and more of America's students lack either the knowledge or the critical intelligence to come to terms with the modern world. There is nothing the matter with our hearts but the problem is our heads.

If anyone had told me, 50, 60 years ago, when I began lecturing, that we would double the number of university graduates, and have a smaller elite of well-educated critics of our time, I would say that was insane. But all the studies show that adults today read less serious literature, less history than they did 30 or 40 years ago, that they are at least as ignorant of the same basic facts as they were 30 or 40 years ago.

To some degree, America is a special case – it is strange beyond belief. In other countries, people may not be well-educated. But few of them have an alternative view of the world that challenges science and makes education almost impossible. About 35 percent of Americans are raised in a way that provides them with a kind of world view that makes them suspicious of science.

At least in France, over one-third of people do not believe that the solar system began ten thousand years ago, that dinosaurs and human beings existed at the same time, and that if one species differs from another it was because God designed them that way.

This world-view was typical in many nations in the late 19th century. Take Britain: people were enraged by Darwin and thought their next-door neighbor was going to hell because they didn't baptize their kids correctly. But slowly this world view faded in Britain, and Canada, and

Australia, and England, and Spain, and Portugal. People who thought of modern science as an enemy, and had this 19th-century perspective, began to disappear.

What the hell happened to America? It is as if a third of the population was taken to Mars, and then came back a hundred years later, and their minds had been in a refrigerator. That is a terrible burden America must carry: about a third of its population has a world view that makes them systematically opposed to learning and critical intelligence.

3. Jacobsen: How much is there a correlation between IQ gains and the advanced moral views that you mentioned before?

Flynn: That is hard to tell. I am only familiar with data within the US. The mean IQ is lower in the South than in states like Minnesota, or like Massachusetts. Despite the preaching of the Southern Baptists and Southern Methodists about the value of fundamentalist Christianity, you have more murder, rape, and early pregnancies than you have up north.

You find a correlation that as IQ rises, people have what I would call more enlightened moral judgment. But you must look at all the confounding variables. Ever since the Civil War, the South has been in a state of schizophrenia. Of course, it is a less prosperous part of the nation. It is a more rural part of the nation. It is a more religious part of the nation. How is one to pick out the causes here? I suspect that thanks to IQ gains over time, some kids raised as Southern Baptists, have learned to be skeptical and to think for themselves. But why has the number been so small?

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An Interview with Dr. Aubrey de Grey on Longevity and Biomedical Gerontology Research Now by Scott Jacobsen

Scott Douglas Jacobsen

Abstract: Dr. Aubrey de Grey is a biomedical gerontologist based in Cambridge, UK and Mountain View, California, USA, and is the Chief Science Officer of SENS Research Foundation, a California-based 501(c) (3) charity dedicated to combating the aging process. He is also Editor-in-Chief of *Rejuvenation Research*, the world's highest-impact peer-reviewed journal focused on intervention in aging. He received his BA and PhD from the University of Cambridge in 1985 and 2000 respectively. His research interests encompass the characterization of all the accumulating and eventually pathogenic molecular and cellular side-effects of metabolism ("damage") that constitute mammalian aging and the design of interventions to repair and/or obviate that damage. Dr. de Grey is a Fellow of both the Gerontological Society of America and the American Aging Association, and sits on the editorial and scientific advisory boards of numerous journals and organizations. He discusses: new research on longevity and longevity escape velocity; promising anti-aging research; research all over the place; advancing research into the Hadwiger-Nelson problem; organizations to look into; books to look into; and final feelings and thoughts on the conversation.

KEYWORDS: Aubrey de Grey, longevity, Rejuvenation Research, SENS Research Foundation.

1. Scott Douglas Jacobsen: What is new about longevity escape velocity and research into it?

Dr. Aubrey de Grey: I could spend a half-hour just talking about that question. It has been a while. Remind me, how long ago was our last interview?

Jacobsen: 2014.

de Grey: All right, things are unrecognizable now. There is a private industry in this. In 2014/2015, it was the time when we created our first spinout. We took out a project philanthropically at SENS Research Foundation. An investor found us.

Jacobsen: Is this Peter Thiel?

de Grey: No, no, another person who had been one of our donors. A guy who was our second biggest donor back then. A guy named Jason Hope. He decided that one of our projects that we had been supporting at Rice University in Texas was ready to be commercialized.

Of course, it was early in terms of becoming a project. He felt that it was far enough along to invest as a project with his own money rather than as a donation. He created a biotech company of his own. He hired our people. He gave us a percent of the company and went off and tried to do it.

He did not have the faintest clue to run a biotech company.

Jacobsen: [Laughing].

de Grey: It changed our attitude to the whole thing. Since then, our business model has been to pursue this kind of thing. It is to pursue projects that are too early to be investible. It is to be in parallel with conversations with potential investors and to identify the right point, where the thing has achieved enough proof of concept.

So, it can be spun out into a company and can receive considerable amounts of support, more than can be provided philanthropically. We have done this half a dozen times. We have been able to do this due to increasing investments at an increasing rate, including deep pocketed ones.

Something that happened 3 years ago with an investor named Jim Mellon who had made his money in a variety of other completely unrelated fields decided that he wanted to get into this. It was the next important thing to him.

He approached me. We started talking. We became very good friends, very quickly. The long of the short is he is the chair of a company called Juvenescence. Its model is basically to invest in other companies.

So, they have already put quite a bit of money into quite several start-ups. Some are spinouts of SENS. Others are closely aligned with what we do. It is transforming everything. It is fantastic. Around the same time, a guy came to us from Germany. A guy named Michael Greve who made his fortune in the early days of the German internet.

He made some of the most successful German websites. He has wanted to do this for a while. He has been investing in a variety of start-ups. The good news is most of these new investors, especially Michael Greve, have been also donating to the foundation as well as investing in companies.

That is very, very important, of course. For the near future, there will be projects that are not far enough along to really join the dots to make a profit. They will need to be funded philanthropically. We try to make the case to investors, even if they are inherently more in an investor mindset than a donor.

We try to make the case. Even if they donate a smaller amount than they are investing, they have as much of my time as they want. They will have the opportunity to have the information, so they will be the founding investor of the next startup.

For me, it is extraordinarily gratifying. I am at the nexus of all of this. Everyone comes to me, whether the investors or the founders of companies who want to find investments. I spend a ridiculous amount of my time just making introductions.

What had not changed, we are still woefully low on the money throughout the foundation. Even though, I have been able, as I say, to put some money in; and we have some money from elsewhere. Nevertheless, it is far less than we need.

I am constantly spending my time on the road and camera trying to change that. That is the biggest thing that has changed. The next thing that we are changing is the huge spike in the value of cryptocurrencies. We benefitted quite a lot from that. Several of our investors who used to be relatively penniless and had not funded us financially suddenly became rather wealthy.

They ended up with a lot of money. We had four 7-digit donations adding up to a total of 6.5 million dollars. So, obviously, this was a windfall. That we are making us of now. Only one of the donors is likely to be a repeat donor because the others decided to give away most of their fortune.

That guy created Ethereum, Vitalik Buterin. He, basically, read my book when he was 14. He is now 26.

Jacobsen: [Laughing].

de Grey: He is one of these true children of the revolution who never had to change their mind about anything. They always grew up knowing it was a sad thing and tried to fix it. So, that is cool. My life is largely the same in broad strokes, but, in the specifics, in terms of the ways in which I can bring the right money to the right people; it has improved a lot.

2. Jacobsen: As aging is numerous processes, what programs of anti-aging, given individual processes of aging, seem the most promising within your remit?

de Grey: When I talk about what is more promising and less promising, I am always looking at the research. I am looking at how SENS is moving forward. Of course, there is a big spectrum to how far along things are.

On the easy end of the spectrum, we have hardly done anything throughout our 10-year existence on stem cell research, even though it is a key area of damage repair. It is a place for others too. Almost every area of stem cell research is important for cell damage and aging, which is being done by others and not us.

While at the other end of the spectrum, things like making backup copies of Mitochondrial DNA, hardly anyone else is working on it. That is a big spectrum. But if I look at the rate of progress, it is not the same at all.

One gratifying thing is making great advances in some difficult areas over the last few years. For mitochondrial DNA, we published a paper about 2 and a half years ago that sounded like only a modest step forward.

Basically, out of the 13 protein coding genes that we need to work in the nucleus, we were able to make two of them work at the same time, in the same cell. It sounds modest, but it is a huge progression from before. With the result now, we have a paper in review, which is a huge step forward from there.

We have these genes working now. We are understanding how we are getting them working. It is not so much trial-and-error now. More of the same thing is crosslinking. So, as you know, the extracellular matrix, this lattice of proteins that gives our tissue their elasticity. It gets less elastic over time because of chemical reaction with circulating sugar.

So, in 2015, the group that we were funding in that area, at Yale University, were able to publish a paper – our first paper in *Science* magazine – on the huge advance in that area. The advance sounded tangential at first hearing with the structure, which is one of the structures responsible for the loss of this elasticity. We want to break it, therefore.

The advance made that was published was ways to create it, to synthesize it, from simple agents. As it turns out, there is an enabling step. It allows us to perform experiments that would be impossible with the very trace amounts of this material that would have been previously available, just making antibody tissue or finding bacterial enzymes that break it down.
That work is proceeding very much faster now, as well. That is one of the companies that we are in the process of spinning out.

3. Jacobsen: If you look at the projections of research that looked very promising, what ones were very disappointing? What ones came out of nowhere and were promising?

de Grey: Of course, they are all over the place. Some of the most important ones were the ones no one cares about. One is pluripotent stem cells created 13 years ago, and CRISPR, which was very much more recent, like 6 years ago.

We have been exploiting those advances. Same with the entire medical profession. But there are also isolated things that have been unexpected. Let us go back to mitochondrial mutations, one thing that we were kicking ourselves over. It will be talked about in the upcoming paper.

It is codon optimization. It is well-known. Mitochondrial DNA has a separate DNA. Codons code different things, different amino acids, compared to the nucleus (in the mitochondria by comparison). One thing is true, which we thought was relevant.

Out of the range of the codons that code for a given single amino acid, let us say the 4 that encode for lysine, there may be one of them used more often than others. This will affect the speed of translation of the messenger RNA among other things.

Nobody had bothered to try to optimize that for expression of these genes in the nucleus. It turns out that if you do then things go far, far better. It was a serendipitous discovery. Science, itself, is full of serendipitous discoveries.

4. Jacobsen: Also, you solved a math problem, recently. What was it?

de Grey: [Laughing] right, that was about 18 months ago. It is a problem called the Hadwiger-Nelson problem named after some mathematicians from 1950s. The question is normally stated, “How many colors do you need to color all of the points on the plane in order that no pair of points that is one inch apart is the same color?”

The answer was immediately shown back in 1950 to be somewhere between 4 and 7 inclusive. I was able to exclude the 4 case. Many, many, many mathematicians have worked on this in the interim. So, it was quite surprising that I was able to do this, as I am a recreational mathematician. I got lucky, basically.

I would describe this as a game. What you do is, you have a two-player game. The playing surface is an initial blank sheet of paper. Player 1 has a black pen. Player 2 has a bunch of colored pens. The players alternate. When player 1 makes a move. The point is to make a new dot wherever player 1 likes.

Player 2 must color the dot. He must take one of his pens and put a ring around the new dot. The only thing that player 2 is not allowed to do is to use the same color as he used for a previous dot that is exactly one inch away from the new dot.

Of course, there may be more than one dot. Player 1 wins the game if he can arrange things so that the new dot cannot be covered. All the player 2's pens have been used for other dots that are exactly an inch away from the new dot, right?

The question is, "How many pens does player 2 need to have in order so that player 1 cannot win?"

Jacobsen: Right.

de Grey: So, if player 2 only has one pen, obviously, player 1 can win with just two dots. He puts a dot down. Player 2 uses the red pen. Player 1 puts down a second dot exactly an inch away. Player 2 cannot move. If player 2 has two pens, then player 1 can win with three dots by just placing a dot; player 2 can uses the red pen, places another dot an inch away.

Player 2 uses the blue pen. Player 1 uses third dot in the triangle with the two, so an inch away from both of them, then player 2 cannot move. So, then, it turns out. If player 2 has 3 pens, player 1 can also win. It is a little more complicated.

Player 1 needs seven dots. But again, it is not very complicated. It was already worked out back in 1950 as soon as humans started thinking about this kind of question. The natural question would be the number of dots go up in some exponential way, but player 1 can always win.

It turns out that that is not true. It turns out if player 2 has seven pens. Then player 1 can never win, no matter how many dots that he puts down. But what I was able to show, if player 2 has 4 pens, then player 1 can win, but with a lot of dots.

The solution that I found took more than 1,500 dots. It has been reduced by other people since then, but it is still over 500 is the record.

5. Jacobsen: [Laughing] if we are looking at the modern landscape, especially with the increase in funding, what organizations should individuals look to – other than your own as well?

de Grey: Things are looking good. There is a huge proliferation of investment opportunities as well, in this area. They are certainly raising money, as they are investing in more start-ups. In the non-profit world, there are plenty of organizations as well.

I should probably mention the Methuselah Foundation, which is the organization from which SENS Research Foundation arose. They are funding a bunch of research as well as doing prizes. They are choosing well and the right things to fund.

Then there is the buck institute, which is a much more traditional organization on the surface. In other words, it is mostly funded by the NIH and by relatively conservative funding sources. But! They understand the scientific situation. It has become much more acceptable to do work that is overtly translational, even if you are getting money from these types of sources.

We work closely with them. We have two ongoing projects there. We send summer interns there. We have been able to work with them on funding, in terms of bringing in new sources of funding. That is something that I would include.

In terms of the world, one important organization is called LEAF or Life Extension Advocacy Foundation. One in the UK. One in the US. One in Russia. They focus on advocacy and outreach. They are extraordinarily good and play a key role in elevating the level of debate in this whole area.

In Europe, the Healthy Life Extension Foundation was founded by two people from Belgium. They run a nice conference every year, every couple of years anyway. They have a vibrant mailing list and spread useful information about this area. They could use some more money. The list goes on now.

There are increased organizations, now, not just in this space but really know what they are doing. They know what the priorities ought to be. One thing I have always known since the beginning. No matter how good I get at outreach and advocacy. I could never do this all myself, not just for lack of time, but because different people resonate with different audiences.
So, there are people who will overall inspire. Others will not like people with beards.

Jacobsen: [Laughing].

de Grey: People may not like my act. So, there are people around now who are very capably complementing the kind of style that I have in communicating the value of this work. That is also extraordinarily important.

6. Jacobsen: Any new books that can provide a good introductory foundation into this kind of research? Also, what about advanced texts as well?

de Grey: On the introductory side, there is one guy named Jim Mellon. So, Jim, this businessperson, has a very interesting of going about his job. He preferentially gets into very emerging new sectors. What he does is, he creates his own competition.

He, essentially, writes newsletters and blogs and books about this new area whose intended audience is other investors. That is what I mean by making his own competition. The reason he does this is, basically, that when a sector is just beginning. That the faster it grows, then the better.

Essentially, it is floating all boats by increasing the buzz around something. He wrote a book based on conversations with me over the previous year or so. It is called Juvenescence, which is the same as the name as his company. It is targeted to other investors.

It is very good. I was able to help with this a fair bit with the technical part. But it is written in a style that is very, very appealing, which is not a way that I would be able to write. He has a second edition upcoming. This is one that I would highlight.

In terms of advanced texts, I would not move to texts right now. Things are moving so fast. One simply needs to read the primary literature. One needs to identify that, which is not necessarily an easy thing to do. I would point to our community's effort.

Probably, the most important one is to fight aging in the blog done by *Reason.* Even though he has become one of the CEOs of our start-up companies, he is running the blog. He is extremely good at highlighting the important points of the research.

7. Jacobsen: Any final feelings or thoughts in conclusion based on the conversation today?

de Grey: I would say, “Thank you for having me on your show again,” and for the opportunity to give an update to your audience. I think, really, the conclusion that I would give is that it is extremely exciting that things are moving much faster than before. But we must not be complacent.

There is still a long way to go. My estimation for how long we must go has gone down, but it has not nearly gone down enough. We still need to be putting in every effort that we possibly can in whatever way.

8. Jacobsen: Thank you for the opportunity and your time, Dr. de Grey.

de Grey: My pleasure, Scott, thank you!

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An Interview with Dr. Ronald K. Hoeflin on High-IQ Societies' Titles, Rarities, and Purposes, and Personal Judgment and Evaluations of Them (Part Two) by Scott Jacobsen

Scott Douglas Jacobsen

Abstract: Dr. Ronald K. Hoeflin founded the Prometheus Society and the Mega Society, and created the Mega Test and the Titan Test. He discusses: inspiration for the Mega Society – its title, rarity, and purpose; inspiration for the Prometheus Society – its title, rarity, and purpose; inspiration for the Top One Percent Society – its title, rarity, and purpose; inspiration for the One-in-a-Thousand Society – its title, rarity, and purpose; inspiration for the Epimetheus Society – its title, rarity, and purpose; inspiration for the Omega Society – its title, rarity, and purpose; the developments of each society over time; communications of high-IQ societies, and harshest critiques of high-IQ societies; overall results of the intellectual community facilitated for the gifted; Prometheus Society and the Mega Society kept separate from the Lewis Terman Society, and Top One Percent Society, One-in-a-Thousand Society, Epimetheus Society, and Omega Society placed under the aegis of the "The Terman Society" or "The Hoeflin Society"; disillusionment with high-IQ societies; notable failures of the high-IQ societies; changing norms of the Mega Test and the Titan Test; the hypothetical Holy Grail of psychometric measurements; other test creators seem reliable in their production of high-IQ tests and societies with serious and legitimate intent respected by Dr. Hoeflin: Kevin Langdon and Christopher Harding; societies helpful as sounding boards for the *Encyclopedia of Categories*; librarian work helpful in the development of a skill set necessary for independent psychometric work and general intelligence test creation; demerits of the societies in personal opinion and others' opinions; virtues and personalities as mostly innate or inborn, and dating and mating; and publications from the societies attempted to be published at a periodic rate.

KEYWORDS: Christopher Harding, Giftedness, intelligence, IQ, Kevin Langdon, Mega Society, Mega Test, Prometheus Society, Ronald K. Hoeflin, The Encyclopedia of Categories, Titan Test.

1. Scott Douglas Jacobsen: Perhaps, we can run down the timeline of the six societies in this part with some subsequent questions: Prometheus Society (1982), Mega Society

(1982), Top One Percent Society (1989), One-in-a-Thousand Society (1992), Epimetheus Society (2006), and Omega Society (2006). What was the inspiration for the Mega Society – its title, rarity, and purpose?

Dr. Ronald K. Hoeflin: Kevin Langdon had a list of 600 or so people who had qualified for his Four Sigma Society from the 25,000 *Omni* readers who tried his LAIT (Langdon Adult Intelligence Test) that appeared in *Omni* in 1979. Four Sigma was given a cut-off of four standard deviations above the mean, which on a normal curve would be about one-in-30,000 in rarity or the 99.997 percentile. So approximately one-thirtieth of them should have been qualified for a one-in-a-million society. I suggested to him that he might ask the top 20 scorers if they'd like to form the nucleus of a one-in-a-million society, but he evidently thought this cut-off was too high to be practical. So when he let his Four Sigma Society languish, I decided to start Prometheus as a replacement for it, with the Mega Society as a follow-through on my suggestion to him about starting a one-in-a-million society, where "mega" means, of course, "million," indicating how many people each member would be expected to exceed in intelligence. With slightly over 7 billion people, there would be a pool of about 7,000 potential Mega Society members, or slightly less if we exclude young children. I knew of a statistical method by which several very high scores from several tests could be combined to equal a one-in-a-million standard, as if the several tests constituted a single gigantic test. So I accepted members using this statistical method until my Mega Test appeared in *Omni* in April 1985. I put the cut-off at a raw score of 42 out of 48 initially, but then increased this to 43 after getting a larger sample. The test was eventually withdrawn from official use for admission to the Mega Society because some psychiatrist maliciously published a lot of answers online that others could search out and copy. At this time my other test, the Titan Test, is the only one that the Mega Society will accept, again at a raw score of 43 out of 48.

2. Jacobsen: What was the inspiration for the Prometheus Society – its title, rarity, and purpose?

Hoeflin: The Prometheus Society, as mentioned above, was intended as a replacement for the Four Sigma Society, which Langdon had allowed to languish. Prometheus was a figure in Greek mythology who was punished by the gods for giving fire to humans. I told Kevin, half in jest, that I was stealing his idea for the Four Sigma Society from him like Prometheus stealing fire from the gods! On my Mega and Titan Test, the qualifying score for Prometheus is a raw score of 36 out of 48, roughly equivalent to a rarity of one-in-30,000 or the 99.997 percentile, the same as Four Sigma's cut-off, i.e., a minimum qualifying score.

3. Jacobsen: What was the inspiration for the Top One Percent Society – its title, rarity, and purpose?

Hoeflin: I wanted to make a living publishing journals for high-IQ societies. I initially was able to do so as the editor for the Triple Nine Society, for which I was paid just $1 per month per member for each monthly journal I put out. When I started as editor in late 1979, there were only about 50 members, but once Kevin's test appeared in *Omni* the number of members swelled to about 750. With $750 per month, I could put out a journal and still have enough left over to live on, since my monthly rent was just $75 thanks to New York City's rent laws. When Kevin heard that I was able to do this, he was not amused, since he thought the editorship should be an unpaid position. So I started the Top One Percent Society from people who had taken my Mega Test in *Omni* in April 1985 and my Titan Test in April 1990, thus removing myself from any disputes with Kevin or other members of the Triple Nine Society. I liked being self-employed rather than work as a librarian, which had been my profession from 1969 to 1985, because difficulties with higher-ups in the library field could crop up if there were personality conflicts.

4. Jacobsen: What was the inspiration for the One-in-a-Thousand Society – its title, rarity, and purpose?

Hoeflin: I started the One-in-a-Thousand Society when income from my Top One Percent Society started to seem insufficient, even when I put out two journals per month rather than one for the Top One Percent Society. The third journal per month was a bit more hectic, but within my capacity.

5. Jacobsen: What was the inspiration for the Epimetheus Society – its title, rarity, and purpose?

Hoeflin: In Greek mythology, Epimetheus was a brother to Prometheus. I'd let the Prometheus and Mega societies fall into the control of other people, so I decided to create new societies at their same cut-offs but with different names and under my control. I don't recall the motivation for founding Epimetheus, since starting in 1997 I qualified for Social Security Disability payments due to my poor vision and low income, and that completely solved all my financial worries, even when my rent gradually crept up from $75 to $150 from 1997 to around 2003. It is now permanently frozen at $150 a month due to an agreement with an earlier landlord, who wanted the City to give him permission to install luxury apartments where I live, for which he could charge $2,000 to $4,000 a month due to the proximity to Times Square, which is just ten minutes' walk away. I think that the Prometheus Society was restricting the tests it accepted to just a very small number of traditional supervised IQ tests, excluding unsupervised amateur-designed tests like mine. I wanted my tests to still serve a practical purpose at the Prometheus and Mega cut-offs.

6. Jacobsen: What was the inspiration for the Omega Society – its title, rarity, and purpose?

Hoeflin: Chris Harding of Australia was forever founding new high-IQ societies with new names but whose existence was largely known only to him and the people he awarded memberships to. He founded an Omega Society at the one-in-3,000,000 cut-off, but I assumed after several years of hearing nothing about it that it must be defunct, so I decided to call my new one-in-a-million society the Omega Society, since "Omega" seemed a nice twin word for "Mega" just as "Epimetheus" served as a twin word for "Prometheus." Chris wrote to me about this appropriation of his society's name and I explained my reason for adopting it. He offered no further complaint about it.

7. Jacobsen: What were the developments of each society over time?

Hoeflin: I decided to devote my full-time attention to a massive multi-volume opus titled "The Encyclopedia of Categories," of which I'd published a couple of one-volume versions in 2004 and 2005. When I noticed that Samuel Johnson's great unabridged dictionary of 1755 could now be bought for just $9.99 from Kindle, the computer-readable format that avoids paper printing, I decided I could make an affordable multi-volume treatment of my "Encyclopedia of Categories." I'd also discovered that quotations from collections of quotations could be analyzed in terms of my theory of categories, giving me a virtually inexhaustible source of examples considering how many quotation books there are out there. So I sold the four societies that were still under my control to Hernan Chang, an MD physician living in Jacksonville, Florida, as well as all of my IQ tests. Although, he lets me score the latter for him and collect the fee, since he is too busy to handle that. I began my multi-volume opus in late 2013 and believe I can complete a 10-volume version by the end of this year, 2019. I was initially aiming at a 13-volume version, in harmony with the number of basic categial niches I employ, but it would take until early 2021 to complete the extra 3 volumes, so I'll publish a 10-volume version in January of 2020. The year 2020 as a publication date appealed to me because of its irony, given that my visual acuity falls far short of 20/20, and the year 2020 rolls around only once in eternity, if we stick to the same calendar. I could still put out more volumes in later editions if I felt so inclined, but I let readers voice an opinion on the optimum number of volumes.

8. Jacobsen: What was the intellectual productivity and community of the societies based on self-reports of members? What have been the harshest critiques of high IQ societies from non-members, whether qualifying or not?

Hoeflin: I think the focus of the higher-IQ societies has been on communication with other members through the societies' journals. I never tried to keep track of the members' "intellectual productivity." As for harsh critiques of the high-IQ societies, the only thing that comes to mind is *Esquire* magazine's November 1999 so-called "Genius" issue. It focused on four high-IQ-society members, including myself. I never read the issue except for the page about myself, and it took me two weeks to get up enough nerve to read even that page. I was told by others that the entire issue was basically a put-down of high-IQ societies and their members, although people said the treatment of me was the mildest of the four. I did notice that they wanted a photo of me that looked unattractive, me using a magnifying glass to read. I suggested a more heroic picture, such as me with one of my cats, but they kept taking pictures of me peering through that magnifying glass in a rather unflattering pose, with zero interest in alternative poses. Kevin Langdon was sarcastic about our willingness to expose ourselves to such unflattering treatment. (He was not among the four that they covered in that issue.)

9. Jacobsen: What have been the overall results of the intended goals of the provision of an intellectual community of like-gifted people who, in theory, may associate more easily with one another? I remain aware of skepticism around this idea, which may exist in the realm of the naive.

Hoeflin: I had found that I could not interact with members of Mensa, who generally treated me as a nonentity. I was also very shy and unable to put myself forward socially in Mensa groups.

At the higher-IQ levels, however, I had the prominent role of editor and even founder, which made it possible for others to approach me and break through that shyness of mine. So I did manage to meet and interact with quite a few people by virtue of my participation in the high-IQ societies, although the ultimate outcome seems to be that I will probably end my life in total isolation from personal friends except a few people who reach out to me by phone or email, as in the present question-and-answer email format. As for other people, they will have to tell you their own stories, since people are quite diverse, even at very high IQ levels.

10. Jacobsen: Why were the Prometheus Society and the Mega Society kept separate from the Lewis Terman Society? Why were the Top One Percent Society, One-in-a-Thousand Society, Epimetheus Society, and Omega Society placed under the aegis of the Lewis Terman Society? Also, what is the Lewis Terman Society?

Hoeflin: I think Hernan Chang adopted the name "The Hoeflin Society" in preference to "The Terman Society" as an umbrella term for the four societies he purchased from me.

11. Jacobsen: What have been the merits of the societies in personal opinion and others' opinions?

Hoeflin: Speaking personally, I have lost almost all interest in the high-IQ societies these days, although I am still a nominal, non-participatory member of several of them. One group I joined recently as a passive member named the "Hall of Sophia" unexpectedly offered to publish my multi-volume book in any format I like for free. The founder had taken my Mega or Titan test earlier this year (February 2019) and did quite well on it, and was sufficiently impressed to classify me as one of the 3 most distinguished members of his (so far) 28-member society. I was going to send out my book for free as email attachments to people listed in the *Directory of American Philosophers* as well as to any high-IQ-society members who might be interested. So for me, the one remaining merit of the high-IQ societies would be to have a potential audience for my philosophical opus.

12. Jacobsen: When did you begin to lose interest or become disillusioned, in part, in high-IQ societies? My assumption: not simply an instantaneous decision in 2019.

Hoeflin: Editing high-IQ-society journals from 1979 onwards for many years, at first as a hobby and then as a livelihood, kept me interested in the high-IQ societies. I gave up the editing completely around 2009. Thirty years is plenty of time to become jaded. Getting Social Security Disability payments in 1997 removed any financial incentive for publishing journals. Over the years I'd travelled to such destinations as California and Texas and Illinois for high-IQ-society meetings, not to mention meetings here in New York City, when I had sufficient surplus income, but all things peter out eventually.

13. Jacobsen: What have been the notable failures of the high-IQ societies?

Hoeflin: There was actually talk of a commune-like community for high-IQ people, but after I saw how imperious some high-IQ leaders like Kevin Langdon were, this would be like joining Jim Jones for a trip to Guyana–insane! That's hyperbole, of course. Langdon actually ridiculed the followers of Jim Jones for their stupidity in following such a homicidal and suicidal leader, not to mention his idiotic ideas. Langdon advocates a libertarian philosophy, but in person he is very controlling. I guess we just have to muddle through on our own, especially if we have some unique gift that we have to cultivate privately, not communally. Langdon often ridiculed my early attempts to develop a theory of categories, but I'm very confident in the theory now that I have worked at it for so long. Human beings tend to organize their thoughts along the same systematic lines, just like birds instinctively know how to build nests, spiders to build webs, and bees to build honeycombs. My analyses are so new and startling that I'm sure they will eventually attract attention. If I'd been an epigone of Langdon, I'd never have managed to develop my theory to its present marvelous stage.

14. Jacobsen: With the Flynn Effect, does this change the norms of the Mega Test and the Titan Test used for admissions purposes in some societies at the highest ranges?

Hoeflin: A lot of people suddenly started qualifying for the Mega Society, perhaps from copying online sources or perhaps from the test suddenly coming to the attention of a lot of very smart people. So initially higher scores on that test were required and then the test was abandoned entirely as an admission test for the Mega Society. Terman found that his subjects achieved gradually higher IQ scores on his verbal tests the older they got. One theory is that as people gradually accumulate a larger vocabulary and general knowledge (crystallized intelligence) their fluid intelligence, especially on math-type tests, gradually declines, so that if one relies on both types of intelligence, then your intelligence would remain relatively stable until extreme old age. There has been no spurt in extremely high scores on the Titan Test, however.

15. Jacobsen: What would be the Holy Grail of psychometric measurements, e.g., a non-verbal/culture fair 5-sigma or 6-sigma test?

Hoeflin: The main problem with extremely difficult tests is that few people would be willing to attempt them, so norming them would be impossible. I was astonished that the people who manage the SAT have actually made the math portion of that test so easy that even a perfect score is something like the 91st percentile. Why they would do such an idiotic thing I have no idea. Terman did the same thing with his second Concept Mastery Test, so that a Mensa-level performance on that test would be a raw score of 125 out of 190, whereas a Mensa-level performance on the first CMT was 78 out of 190. Twenty members of his gifted group had raw scores of 180 to 190 on the second CMT whereas no member of his group had a raw score higher than 172 out of 190 on the first CMT. His reason was to be able to compare his gifted group with more average groups such as Air Force captains, who scored only 60 out of 190 on the second test, less than half as high as Mensa members. A lot of amateur-designed intelligence tests have such obscure and difficult problems that I am totally unable to say if those tests have any sense to them or not. Perhaps games like Go and Chess are the only ways to actually compare the brightest people at world-record levels. But such tests yield to ever-more-careful analysis by the competitors, so that one is competing in the realm of crystallized intelligence (such as knowledge of chess openings) rather than just fluid intelligence. Even the brightest people have specialized mental talents that help them with some tests but not with others, like people who compete in the Olympic Decathlon, where some competitors will do better in some events and others in other events, the winner being the one with the best aggregate score. General intelligence means that even diverse tests like verbal, spatial, and numerical ones do have some positive intercorrelation with each other–they are not entirely independent of each other. The best tests select problems that correlate best with overall scores. But few if any of the amateur-designed tests have been subjected to careful statistical analysis. Some people did subject my Titan Test to such statistical analysis and found that it had surprisingly good correlations with standard intelligence tests, despite its lack of supervision or time limit.

16. Jacobsen: Other than some of the work mentioned. What other test creators seem reliable in their production of high-IQ tests and societies with serious and legitimate intent? Those who you respect. You have the historical view here – in-depth in information and in time. I don't.

Hoeflin: I think Kevin Langdon's tests are very well made and intelligent, but he tends to focus on math-type problems. Christopher Harding, by contrast, focuses on verbal problems and does poorly in math-type problems. For international comparisons across languages, I guess one would have to use only math-type problems, as I did in my Hoeflin Power Test, which collected the best math-type problems from the three previous tests (Mega, Titan, and Ultra). But English is virtually a universal language these days, so perhaps verbal tests that focus on English or perhaps on Indo-European roots could be used for international tests, except that Indo-European languages constitute only 46% of all languages, by population. I think Chinese will have difficulty becoming culturally dominant internationally because the Chinese language is too difficult and obscure for non-Chinese to mess with.

17. Jacobsen: Were the societies helpful as sounding boards for the *Encyclopedia of Categories*?

Hoeflin: I used high-IQ-society members as guinea pigs to develop my intelligence tests, but my work on categories I have pursued entirely independently, except for the precursors I rely on, notably the philosopher Stephen C. Pepper (1891-1972), who taught at the University of California at Berkeley from 1919 to 1958. Oddly enough, in his final book titled *Concept and Quality* (1967) he used as a central organizing principle for his metaphysics what he called "the purposive act," of which he said on page 17: "It is the act associated with intelligence"!!! I simply elaborated this concept from 1982 when I first read *Concept and Quality* onward, elaborating it into a set of thirteen categories by means of which virtually any complete human thought or action, as in a quotation, can be organized. In my introductory chapter, which currently traces the development of my theory from William James last book, *A Pluralistic Universe*, to the present, I now plan to trace the thirteen categories not just to the Greeks and Hebrews but back to animal life and ultimately back to the Big Bang, breaking the stages of its development into 25 discrete ones including my own contributions toward the end. I may begin with Steven Weinberg's book *The First Three Minutes* and end with Paul Davies kindred book, *The Last*

Three Minutes, if I can manage to extract convincing 13-category examples from each of these books.

18. Jacobsen: How was librarian work helpful in the development of a skill set necessary for independent psychometric work and general intelligence test creation?

Hoeflin: It was mostly helpful to me because I could work part-time during the last ten years of my 15 or 16 years as a librarian, which gave me the leisure for independent hobbies, thought, and research.

19. Jacobsen: What have been the demerits of the societies in personal opinion and others' opinions?

Hoeflin: There tends to be a lot of arrogance to be found among members of the high-IQ societies, so charm is typically not one of their leading virtues. They generally assume that virtually everyone they speak to is stupider than they are.

20. Jacobsen: How can members be more humble, show more humility? Also, what are their leading virtues?

Hoeflin: I think personalities are largely inborn and can't be changed much. Perhaps there should be sister societies, analogous to college sororities, for women who have an interest in socializing with high-IQ guys for purposes of dating and mating. In the ultra-high-IQ societies, women constitute only about 6% of the total membership. (Parenthetically, if you look at the Wikipedia list of 100 oldest living people, one usually finds about 6 men and 94 women.) In Mensa, the percentage of women typically ranges from 31% to 38%.

21. Jacobsen: How many publications come from these societies? What are the names of the publications and the editors in their history? What ones have been the most voluminous in their output – the specific journal? Why that journal?

Hoeflin: Each society generally has a journal that it tries to publish on a regular basis. Kevin Langdon puts out *Noesis*, the journal for the Mega Society, about twice per year. I also get journals from Prometheus and Triple Nine and Mensa. The four societies Hernan Chang operates all function entirely online, and I have never seen any of their communications. Even the journals I get I only glance at, never read all the way through. Due to my very slow reading speed, I tend to focus my reading on books that seem worthwhile from which to collect examples for my "Encyclopedia of Categories."

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An Interview with Dr. Ronald K. Hoeflin on Theories of Intelligence, Sex Differences, and Issues of IQ Test Takers and Test Creators (Part Three) by Scott Jacobsen

Scott Douglas Jacobsen

Abstract: Dr. Ronald K. Hoeflin founded the Prometheus Society and the Mega Society, and created the Mega Test and the Titan Test. He discusses: faux and real genius; validity to Professor Robert Sternberg's Triarchic Theory of intelligence with practical intelligence, creative intelligence, and analytical intelligence; validity to Multiple Intelligences Theory of Professor Howard Gardner with musical-rhythmic, visual-spatial, verbal-linguistic, logical-mathematical, bodily-kinesthetic, interpersonal, intrapersonal, naturalistic, existential, and teaching-pedagogical intelligences; validity to general intelligence, or g, of the late Charles Spearman; the general opinion on the three main theories of intelligence; self-identification as a genius; personal opinions on the state of mainstream intelligence testing and alternative high-range intelligence testing; statistical rarity for apparent and, potentially, actual IQ scores of females who score at the extreme sigmas of 3, 4, and 5, or higher; reducing or eliminating social conflicts of interest in test creation; multiple test attempts; data on the Mega Test and the Titan Test; pseudonyms and test scores; and possible concerns of the test creators at the highest sigmas.

KEYWORDS: Charles Spearman, Francis Galton, Hereditary Genius, Howard Gardner, intelligence, IQ, Mega Society, Mega Test, Robert Sternberg, Ronald K. Hoeflin, The Encyclopedia of Categories, Titan Test.

1. Scott Douglas Jacobsen: Before delving into the theories, so a surface analysis, what defines a faux genius? What defines a real genius to you? Or, perhaps, what different definitions sufficiently describe a fake and a true genius for non-experts or a lay member of the general public – to set the groundwork for Part Three?

Dr. Ronald K. Hoeflin: I would say that genius requires high general intelligence combined with high creativity. How high? In his book *Hereditary Genius,* Francis Galton put the lowest grade of genius at a rarity of one in 4,000 and the highest grade at a rarity of one in a million. Scientists love to quantify in order to give their subject at least the appearance of precision. One in 4,000 would ensure one's being noticed in a small city, while one in a million would ensure one's being noticed in an entire nation of moderate size.

2. Jacobsen: By your estimation or analysis, any validity to Professor Robert Sternberg's Triarchic Theory of intelligence with practical intelligence, creative intelligence, and analytical intelligence?

Hoeflin: I like Sternberg's attempt at analyzing intelligence, but clearly just three factors seems a bit skimpy for a really robust theory.

3.Jacobsen: Any validity to Multiple Intelligences Theory of Professor Howard Gardner with musical-rhythmic, visual-spatial, verbal-linguistic, logical-mathematical, bodily-kinesthetic, interpersonal, intrapersonal, naturalistic, existential, and teaching-pedagogical intelligences?

Hoeflin: Here we have a more robust set of factors, but Gardner fails to show how his factors cohere within a single theory.

4. Jacobsen: Any validity to general intelligence, or g, of the late Charles Spearman?

Hoeflin: General intelligence was based on the fact that apparently quite diverse forms of intelligence such as verbal, spatial, and numerical have positive correlations between each pair of factors, presumably based on some underlying general intelligence.

5. Jacobsen: Amongst the community of experts, what is the general opinion on the three main theories of intelligence listed before? What one holds the most weight? Why that one?

Hoeflin: These are three theories in search of an overarching theory of intelligence. My guess is that the so-called "experts" lack the intelligence so far to create a really satisfactory theory of intelligence, perhaps analogous to the problem with finding a coherent theory of superstrings.

6. Jacobsen: Do you identify as a genius? If so, why, and in what ways? If not, why not?

Hoeflin: I think my theory of categories shows genuine genius. It even amazes me, as if I were just a spectator as the theory does its work almost independently of my efforts.

7. Jacobsen: Any personal opinions on the state of mainstream intelligence testing and alternative high-range intelligence testing now?

Hoeflin: I'm not up on the current state of intelligence testing. I do feel that it has focused way too much on the average range of intelligence, say from 50 to 150 IQ, i.e., from the bottom one-tenth of one percent to the top one-tenth of one percent. Testing students in this range is where the money is in academia. It's like music: all the money to be made is in creating pop music, which is typically of mediocre quality. Background music for movies is probably as close as music comes these days to being of high quality, presumably because there is money to be made from the movie studios in such music. I saw a movie recently called "Hangover Square," which came out in 1945. The title is unappealing and the movie itself is a totally unsuspenseful melodrama about a homicidal maniac whose identity is revealed right from the start. The one amazing thing about the movie was that the composer, Bernard Herman, composed an entire piano concerto for the maniac to purportedly compose and perform, with appropriate homicidal traits in the music to reflect the deranged soul of the leading character, the maniac. One rarely sees such brilliant musical talent thrown at such a horrible film. So I guess genius can throw itself into things even when the audience it is aimed at is of extremely mediocre quality. Maybe intelligence tests, even when they are aimed at mediocre students, can show glints of genius. The fact that I could attain the 99th percentile on tests aimed at average high-school students despite my slow reading due to visual impairment suggests that some psychometrician (or group of psychometricians) must have been throwing their creativity and intelligence into their work in an inspired way that smacks of true genius!

8. Jacobsen: Do the statistical rarities at the extreme sigmas have higher variance between males and females? If so, why? If not, why not? Also, if so, how is this reflected in subtests rather than simple composite scores?

Hoeflin: By "variance between males and females," I presume you are alluding to the fact that there tend to be more men at very high scores than women. This is especially obvious in spatial problems, as well as kindred math problems, presumably due to men running around hunting wild game in spatially complex situations while women sat by the fireside cooking whatever meat the men managed to procure. But it is also true that men outperform women on verbal tests. On the second Concept Mastery Test, a totally verbal test, of the 20 members of Terman's gifted group who scored from 180 to 190, the ceiling to the test, 16 were men but only 4 were women. This is a puzzling phenomenon, given women's propensity for verbalizing. Perhaps chasing game involves verbal communication, too, so that nature rewards the better verbalizers among men in life-or-death situations. Warfare as well as hunting for game probably has a significant role in weeding out the unfit verbalizers among men.

9. Jacobsen: Following from the last question, if so, what does this imply for the statistical rarity for apparent and, potentially, actual IQ scores of females who score at the extreme sigmas of 3, 4, and 5, or higher?

Hoeflin: It obviously would be possible to breed women eugenically to increase the percentage of them with very high IQ scores. Even now, there are more women graduating from law school than men in the United States, which suggests no deficit in verbal intelligence at the high end of the scale. Although, there may be other reasons why men of high verbal intelligence avoid law as a career compared to women. Maybe, they are drawn away by other lucrative careers, such as business or medicine.

10. Jacobsen: In the administration of alternative tests for the higher ranges of general intelligence, individuals may know the test creator, even on intimate terms as a close colleague and friend. They may take the test a second time, a third time, a fourth time, or more. The sample size of the test may be very small. There may be financial conflicts of interest for the test creator or test taker. There may be various manipulations to cheat on the test. There may be pseudonyms used for the test to appear as if a first attempt at the alternative test. There are other concerns. How do you reduce or eliminate social conflicts of interest?

Hoeflin: Some people have used pseudonyms to take my tests when they were afraid I would not give them a chance to try the test a second or third time. There is not much incentive to score very high on these tests, except perhaps the prestige of joining a very high-IQ society.

People cheat on standardized college admission tests, as we know from news reports, by getting other people to take the tests for them, for example. Considering how expensive colleges have become these days, my guess is that they will go the way of the dodo bird eventually, and people will get their education through computers rather than spending a fortune in a college. One guy cheated on my Mega Test by getting members of a think tank in the Cambridge, Massachusetts area to help him. He was pleased that I gave him a perfect score of 48 out of 48. He admitted cheating to Marilyn vos Savant, who informed me, so I disqualified his score. This was before my Mega Test appeared in *Omni.* Why he wanted credit for a perfect score that he did not deserve is beyond my understanding. I'd be more proud of a slightly lower score that I had actually earned. Another person has kept trying my tests, despite a fairly high scoring fee of $50 per attempt. I finally told him to stop taking the tests. His scores were not improving, so his persistence seemed bizarre.

11. Jacobsen: The highest score on the Mega Test on the first attempt by a single individual with a single name rather than a single individual with multiple names was Marilyn vos Savant at 46 out of 48. Similarly, with other test creators, and other tests, there were several attempts at the same test by others. Do the multiple test attempts and then the highest of those attempts asserted as the score for the test taker present an issue across the higher sigma ranges and societies?

Hoeflin: Some European guy did achieve a perfect score on the Mega Test eventually, about 20 years after the test first came out in 1985. The test is no longer used by any high-IQ societies that I know of due to the posting of mostly correct answers online by a malicious psychiatrist. He probably needed to see a psychiatrist to figure out what snapped in his poor head to do such a thing. I guess it's a profession that attracts people with psychological problems that they are trying to understand and perhaps solve.

12. Jacobsen: What were the final sample sizes of the Mega Test and the Titan Test at the height of their prominence? How do these compare to other tests? What would be a reasonable sample size to tap into 4-sigma and higher ranges of intelligence with low margins of error and decent accuracy?

Hoeflin: A bit over 4,000 people tried the Mega Test within a couple of years of its appearance and about 500 people tried the Titan Test within a similar time period. Langdon's LAIT test is said to have had 25,000 participants. His test was multiple choice, whereas mine were not. A multiple-choice test is easier to guess on than a non-multiple-choice test. My tests were normed by looking at the previous test scores that participants reported and then trying to create a distribution curve for my tests what would jibe with the distribution on previously-taken tests. So I did not need to test a million or more people to norm my tests up to fairly high levels of ability.

13. Jacobsen: What are the ways in which test-takers try to cheat on tests? I mean the full gamut. I intend this as a means by which prospective test takers and society creators can arm themselves and protect themselves from cheaters, charlatans, and frauds, or worse. Same for the general public in guarding against them, whenever someone might read this.

Hoeflin: If people's wrong answers are too often identical with one another and out of sync with typical wrong answers, that is a clue that they are copying from one another or from some common source.

14. Jacobsen: Why do test takers use pseudonyms? How common is this practice among these types of test-takers? It seems as if a brazen and blatant attempt to take a test twice, or more, and then claim oneself as smart as the higher score rather than the composite of two, or more, scores, or even simply the lower score of the two, or more, if the scores are not identical.

Hoeflin: I know of a group of 5 M.I.T. students who collaborated and gave themselves the collective name of Tetazoo. There was also a professor at Caltech who tried the test but did not want his score publicized so he used the pseudonym Ron Lee. In both cases, the score just barely hit the one-in-a-million mark of 43 right out of 48. One person scored 42 right and wanted to try again so he used a pseudonym and managed to reach 47 right out of 48 on his second attempt.

15. Jacobsen: What have been and continue to be concerns for test creators at the highest sigmas such as yourself or others, whether active or retired? This is more of a timeline into the present question of the other suite of concerns.

Hoeflin: I do not know what are the main concerns of test designers, past or present, other than myself. I was fortunate to have Triple Nine members as guinea pigs to try out my trial tests, so I could weed out the less satisfactory problems. One could usually tell just by looking at a problem whether it would be a good one or not, but the inspiration to come up with good problems would involve steady effort over the course of a year or so, yielding for me on average about one good problem per week, plus about four not too good problems per week.

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