CHAPTER 8

Biocosmic Pessimism

The Decline of the West Is Multifaceted, and Other Considerations

Given the findings presented in the previous chapter, concerning the role of the social epistasis amplification model (SEAM) in understanding the "decline" of Western populations and cultures, it needs to be stressed that the reality of Western decline is multi-dimensional, with many independent and complementary factors contributing. Contemporary work has examined several of these elements, which include recent (i.e. since circa 1850) "dysgenic" trends in *g*, probably brought on through a climate-change-related shift of the balance of selection in Western populations from the group to the individual level (Woodley of Menie, Figueredo, et al., 2017), and heightened exposure to evolutionary novelty and resultant maladaptive and supernormal stimulation of certain psychobehavioral responses (evolutionarily novel levels of conspicuous wealth inequality may be one such stimulus, and these potentially overactivate the egalitarian aspects of human moral psychology; Charlton, 1997; Woodley, 2010). There is also a host of proximate-level factors involving purely cultural evolutionary trends that doubtlessly have unique effects on general social malaise and its consequences (such as rising nihilism and declining fertility) in Western groups and perhaps others (as discussed in Chap. 7).

This is not to say that the SEAM lacks considerable power as an explanation for biocultural decline. That the results of the previous chapter's

M. A. Sarraf et al., *Modernity and Cultural Decline*,
https://doi.org/10.1007/978-3-030-32984-6_8

analysis are robust to controlling for both the natural log of time[1] and also the independent effects predicted by rational-choice theories of the demographic transition (e.g. Galor, 2012) suggests that the SEAM does have such power. In the theoretically favored (and more parsimonious) model, the social epistasis factor accounts for 56% of the variance in the global fitness factor, independent of other predictors. There is a distinct possibility that SEAM dynamics are present in non-Western cultural contexts, which merits further study. Many non-Western countries are succumbing to the same modernization effects (Bongaarts, 2009). The fact that the SEAM can potentially account for the cross-cultural generalizability of the demographic transition using a single causal mechanism (i.e. the accumulation and vertical transmission of spiteful mutations, and thus their negative effects on social epistasis) gives the model scientific appeal. The SEAM might capture a *sufficient* cause of biocultural decline, but not a *necessary* one.

So our findings leave room for other proximate and also distal biocultural factors in Western decline. Indeed, there may be subtle interactions among these different factors, which tie them to the dynamics of SEAM. Many of the proximate-level explanations for the demographic transition are based on the idea that individuals make rational tradeoffs among outcomes for which they have variable preferences. For example, people may "trade" offspring quality against offspring quantity or fertility against personal human capital—such as when an individual devotes years of his or her life to education that could be used to have and rear offspring (Galor, 2012). The fact that the "costs and benefits" of specific behaviors and activities vary with "particular forms of culture" (MacDonald, 2009, p. 208) predictably leads to conflict in the construction of culture among persons whose preferences differ for genetic reasons (MacDonald, 2009). We might further say that genetic differences among individuals, and groups of individuals, drive them to shape their environments and ecologies in ways that suit their individual or corporate (group-level) genotypes, such as to, for example, facilitate the maximal satisfaction of certain preferences.

But individuals exhibit unequal effectiveness in so transforming their surroundings. One factor determining variation in this effectiveness may

[1] This shows that the findings do not result from so-called temporal autocorrelation effects, or the confounding of temporal-trend data by the closeness of measurement occasions to one another in time.

be individuals' average genetic similarity to the other people constituting their group. To the extent that Western populations have taken on progressively larger shares of individuals carrying spiteful mutations, and have become adapted to inter-individual as opposed to inter-group competition, those who do not carry spiteful mutations are likely progressively less advantaged, and thus unsurprisingly less successful, in the competition with the carriers of these mutations to structure culture. People not carrying spiteful mutations may "lose out" to a dyscorporate elite insofar as the former are compelled to align their explicit preferences to those of said elite, who may impose their preferences in a top-down fashion. In light of considerations in the prior chapter linking negative social epistasis to low fertility, it may be that a hallmark of a society undergoing social-epistatic decay is a prevalence of inducements to low fertility. These may be both economic and cultural and seem to be coupled with the derogation and deconstruction of systems of traditional values. Further, such inducements and effective "anti-values" are likely transmitted vertically via both genetic and cultural inheritance mechanisms that adapted cultural groups for high levels of inter-group conflict historically, but, in the absence of this conflict, lead to rapid group fitness collapse.

Dysgenic Selection Against *g* and the Co-occurrence Model

Another major biocultural model, discussed in previous chapters, is the dysgenic selection model, which is based on the observation that among those with lower *g* or proxies for it, fertility is typically higher than among those with higher levels of the trait, which suggests, given the relatively high heritability of *g*, that over time the trait should decrease (Galton, 1869; Lynn, 1996; Skirbekk, 2008). The regime of selection that favors the fitness of those with lower levels of *g*, and also reduces the fitness costs associated with high mutation load, is characterized by environmental mildness engendering an absence of inter-group conflict; this in turn yields diminution of social harshness, to which those with (or probably with) low *g* and those with high mutation load were historically far more vulnerable than those with high *g* and those with low mutation load (Clark, 2007; Woodley of Menie, Figueredo, et al., 2017). Moreover, the low-*g* and high-mutation-load groups partially overlap—it has been found that mutations, specifically rare variants, predict a large percentage of the variance among individuals in levels of *g* (Hill et al., 2018). Given the presence of small-magnitude negative associations between *g* and indicators of developmental instability, such as fluctuating asymmetry (Banks, Batchelor, & McDaniel, 2010), which may be associated with mutation load, the accumulation of relatively more common variants (as discussed in Chap. 6) may be directly contributing to the decline in *g*. For example, craniofacial shape asymmetry (as a measure of fluctuating asymmetry) is likely negatively related to *g*, and so its increase potentially indicates a *g* decline of 0.16 points (on a standard IQ scale) per decade (Woodley of Menie & Fernandes, 2016b). Additionally, the secular increase in sinistrality may correspond to an increase in mutation load that has reduced *g* by 0.01 points per decade (Woodley of Menie, Fernandes, Kanazawa, & Dutton, 2018). The average decline across such indicators is 0.09 points per decade.

The overall decline in *g* is probably much larger (with estimates ranging from −0.38 points per decade [Woodley of Menie, 2015] to around −1.3 points per decade when the decline in variants associated with *g* are directly measured and extrapolated to a dysgenics rate estimate [see discussion of Abdellaoui et al., 2019 in Chap. 5]). This decline seems to be driven primarily by selection pressures that favor the fitness of lower-*g* phenotypes (Reeve, Heeney, & Woodley of Menie, 2018) and genotypes exhibiting lower frequencies of genetic variants predictive of educational attainment and *g* (Beauchamp, 2016; Conley et al., 2016; Kong et al., 2017; Woodley of Menie, Rindermann, Pallesen, & Sarraf, 2019; Woodley of Menie, Schwartz, & Beaver, 2016). A subset of studies relevant to selection for intelligence used polygenic scores[2] predictive of cognitive ability to estimate the resultant decline in the phenotype of interest. For instance, using a US sample, Beauchamp (2016, *cf.* Woodley of Menie, 2016) estimated a loss in educational attainment equivalent to 1.5 months per generation. And Kong et al. (2017), using a large Icelandic sample, estimated a loss in IQ of −0.3 points per decade. As each study utilized very low estimates for the additive heritability of educational attainment and IQ, respectively, these are likely substantial underestimates of the true *g* loss, which may fall in the range of 0.5 to 1 points per decade on a standard IQ scale, i.e. with a median of 100 and standard deviation of 15 (Woodley of Menie, Figueredo, et al., 2017). An even more recent study employing the Wisconsin Longitudinal Study (Woodley of Menie et al., 2019) and utilizing a newly released educational attainment polygenic score also estimated *g* decline and employed the same

[2] A “polygenic score” tracks some set of genetic variants reliably associated with a particular phenotype or outcome.

formula as Kong et al. (2017). It found that with a low-end additive heritability estimate for IQ ($h^2 = 0.4$), IQ would be expected to decline at a rate of −0.21 IQ points per decade; however, this rate doubles when a classic behavior-genetic estimate of the additive heritability of IQ is used ($h^2 = 0.8$; IQ decline = −0.42 points per decade).

The Flynn effect constitutes a major challenge to predictions stemming from the dysgenic selection model, because population-level performance across IQ batteries in different countries has been rising at a rate of three IQ points per decade on average over roughly the past century (Pietschnig & Voracek, 2015; Trahan, Stuebing, Hiscock, & Fletcher, 2014). Knowledge of this phenomenon (despite being called the Flynn effect, after James Flynn, who did more than anyone else to bring it to widespread attention) predates Flynn by several decades. Those explicitly looking for evidence of dysgenic declines in intelligence made some of the earliest observations of the effect (Cattell, 1950). The apparent failure of efforts to detect these declines despite apparent dysgenic selection was subsequently termed *Cattell's paradox* (Higgins, Reed, & Reed, 1962), after psychometrician Raymond B. Cattell, who was a committed proponent of the dysgenic selection model in the early decades of the twentieth century (Cattell, 1937). A position emerged in the 1990s to the effect that dysgenic selection was so far only reducing genotypic IQ (i.e. the genetic basis of intelligence), but that environmental enrichments of one sort or another (e.g. increased health, wealth, nutrition, etc.; Lynn, 1996) more than offset this genetic effect and so were enhancing phenotypic IQ. In other words, IQ-test performance was rising despite dysgenic selection (Loehlin, 1997 and Lynn, 1996 expressed the idea with the image of "rising tides" lifting "leaky boats").

More recently, however, another solution to Cattell's paradox was proposed, drawing on the idea that dysgenic selection and the Flynn effect have their effects on different variance components of IQ. The first major variance component is general intelligence or *g*, discussed earlier in this book, and the second is (collectively) specialized mental abilities (sometimes abbreviated to *s*), which are narrow factors each of which predicts variance in performance on specific cognitive tasks (Carroll, 1993; Spearman, 1904). (These can be further divided into heritable [*g.h*] and environmental [*g.e*] general intelligence, as well as heritable [*s.h*] and environmental [*s.e*] specialized abilities.)

Moderation analysis has found that the magnitude of the negative correlation between performance on a subtest of an IQ battery and fertility is positively related to that subtest's *g* loading, meaning that the more perfectly a subtest measures *g*, the greater will be the magnitude of the negative association between performance on that subtest and fertility (Woodley of Menie, Figueredo, et al., 2017). Additionally, the correlation between the heritability of performance on an IQ subtest and *g* is very strong, and may even be perfect (i.e. 1.0; van Bloois, Geutjes, te Nijenhuis, & de Pater, 2009; Voronin, te Nijenhuis, & Malykh, 2016). But in considering the Flynn effect, it is the subtests that most *weakly* measure *g* that show the largest gains in population-level performance over time (te Nijenhuis & van der Flier, 2013). Therefore, dysgenic selection acts on the most heritable variance component of IQ (*g*), whereas the Flynn effect acts on the less heritable variance component(s) (those sources of *s* that can be easily trained or are most responsive to enhancement of phenotypic condition).

This *co-occurrence model* predicts that if a measure of cognitive ability can function as a *stable* measure of *g* over time by virtue of measurement invariance (lack of measurement invariance, or the tendency of an instrument to measure different parameters across different measurement occasions, is a methodological problem associated with measurement of the Flynn effect; Wicherts et al., 2004), then performance on it should show a decline consistent with the action of dysgenic selection. Indicators that reveal this pattern include simple visual and auditory reaction times (Madison, Woodley of Menie, & Sänger, 2016; Woodley of Menie, te Nijenhuis, & Murphy, 2015), 3D spatial rotation ability (Pietschnig & Gittler, 2015), (certain facets of) ability-based emotional intelligence (Pietschnig & Gittler, 2017), working memory capacity (measured using backward digit span and backward Corsi block span; Wongupparaj, Wongupparaj, Kumari, & Morris, 2017; Woodley of Menie & Fernandes, 2015), utilization frequencies of high-difficulty vocabulary items (Woodley of Menie, Fernandes, Figueredo, & Meisenberg, 2015), and color-hue discrimination ability (Woodley of Menie & Fernandes, 2016a). The most significant potential manifestations of declining *g* include factors of social significance related to complex problem-solving ability, such as the per capita rates of macro-innovation and also the frequencies of eminent individuals responsible for the production of such innovation, both of which have declined precipitously since the mid-nineteenth century (Huebner, 2005a; Murray, 2003; Woodley & Figueredo, 2013; Woodley of Menie, Figueredo, et al., 2017). These "reverse" Flynn effects were recently termed "Woodley effects," after Michael A. Woodley of Menie, who, along with Bruce Charlton, first hypothesized their existence (Sarraf, 2017). Importantly, the declines in the frequencies of genetic variants positively associated with educational attainment and *g* (established using temporal data collected from Iceland and the United States) have been found to predict 25% of the variance in a latent chronometric factor comprised of various Woodley effects, even after controlling for time and changing levels of neurotoxic pollution (Woodley of Menie, Sarraf, Peñaherrera-Aguirre, Fernandes, & Becker, 2018).

Woodley of Menie, Figueredo, et al. (2017) developed a model that ties the consequences of increasing mutation load (such as increasing BMI, sinistrality, and fluctuating asymmetry) to parallel temporal trends among various "Woodley effects" and Flynn effects through a latent nexus factor. This factor captures the shared temporal variance among three latent chronometric factors (estimated in the same way as those employed in the analysis in Chap. 7): one capturing trends in various indicators of declining heritable general intelligence (*g.h*), one capturing trends in various indicators of rising environmentally sensitive specialized abilities (*s.e*), and one capturing trends in various somatic modifications (*s.m*), which include trends likely tracking mutation accumulation (such as fluctuating asymmetry) and those tracking environmental improvements (such as increasing height). The latent nexus variance among these convergent measures stems from increasing climatological mildness changing the patterns of selection pressure acting on various traits (this is consistent with the presence of a temporal correlation of −0.8, $p < 0.05$ between an estimate of global temperature increase and the nexus factor score spanning the years 1810 to 2010). It was predicted that a major factor that reversed due to increasing climatological mildness was group-selective pressure, with groups no longer having to compete for scarce resources as a consequence of the challenges related to cold, harsh, and variable climates (Woodley & Figueredo, 2013; Woodley of Menie, Figueredo et al., 2017; Zhang et al., 2011).

With a warmer climate, socio-ecological pressures, which formerly favored the fitness of those with high levels of *g* and placed a large fitness premium on low levels of mutation load, are relaxed. This permits those with lower *g* to gain a relative fitness advantage over those with higher *g* (who increasingly employ technology, such as contraceptives, to regulate their fertility and trade this against the acquisition of human capital, e.g. educational attainment), and relaxed negative selection allows the population burden of relatively more common and mildly deleterious, in addition to prospectively rarer and much more deleterious, mutations, including spiteful ones, to increase. Indeed, the process of mutation-induced demographic decline and concomitant alterations in patterns of social epistasis, as discussed in Chap. 7, may be potentiating dysgenic selection and thus the decline in *g* in Western populations, in that the relatively high social sensitivity of those with higher *g* may render them more susceptible to epigenetically phenocopying anti-fitness values and norms emanating from an elite potentially burdened with spiteful mutations (Dutton & van der Linden, 2015; Woodley, 2010). This is consonant with the finding of a negative correlation between the strength of dysgenic selection (scaled negatively) and time in a recent meta-analysis of studies of dysgenic fertility for IQ, indicating that the strength of dysgenic selection has increased over time (Reeve et al., 2018; $r = -0.37$, $p = 0.05$).

Cycles of Time

Western (and maybe other) groups are apparently locked in biocultural cycles characterized initially by periods of intense inter-group conflict driven by harsh climates (Zhang et al., 2011), chronic downward social mobility (Clark, 2007, 2014), strong negative selection against (especially spiteful) mutations, and consequent bootstrapping of these populations as *g* and other traits associated with industriousness rise, along with population size and corporate fitness (Woodley of Menie, Figueredo, et al., 2017; see also Weiss, 2007). Then these societies start to degrade. Increased climatic mildness reduces the strength of negative selection, permitting mutations to accumulate. Under a regime of individual-level selection, those with lower *g* gain a relative reproductive advantage over those with higher *g*, giving rise to the Woodley effect and decreased innovativeness and cultural vitality. Great accomplishments (such as putting a man on the Moon) become rare and are replaced with other priorities. Societies become overwhelmed with spiteful mutations and the resultant veneration of nihilistic and anti-group-selected norms coincides with an epidemic of psychobehavioral abnormalities, leading to growing individual alienation and social dysfunction.

On the surface, there are improvements, such as increases in wealth, (aspects of) health, and (the *s.e* component of) IQ, in addition to reductions in early-life mortality and both inter- and intra-group violence. Continuing selection favoring certain components of slow life history strategies may in part drive these trends in modernizing and modernized populations (Woodley of Menie, Cabeza de Baca, Fernandes, Madison, & Figueredo, 2017). But as noted in Chap. 5's critique of Steven Pinker's optimism regarding the supposed fruits of the Enlightenment, these trends are in fact masking a collapse, presumably back into a Malthusian regime, in that civilization is no longer able to solve the increasingly complex problems associated with maintaining a developed and highly stratified techno-economy. In such a setting, the civilization succumbs to what can best be described as mass senescence, as its population simply fails to reproduce itself and, eventually, large numbers of individuals die off, recapitulating the observed historical demographic dynamics of both ancient Rome (Dutton & Woodley of Menie, 2018) and Calhoun's mouse utopia Universe 25 (Calhoun, 1973).

Techno-optimists of various flavors tout the inevitability of certain forms of scientific progress that will yield and have yielded potential solutions to the problem of biocultural decline, such as pre-implantation genetic diagnosis, embryo selection, germ-line gene therapy, CRISPR (which can be used to remove deleterious mutations), and radical life extension (e.g. Bostrom, 2002). The more wildly enthusiastic members of this crowd have even promoted the idea that it may be possible to upload the human mind to, and realize it on, a computational substrate, once the requisite computing power is available and the resolution of brain-scanning technology is high enough to capture the ultrastructure of the neurocytoarchitectonics of the brain so as to permit reliable digital reconstruction (Kurzweil, 2004). This has led to much scientific and philosophical speculation under the banner of "transhumanism" concerning what has come to be termed the *Singularity Hypothesis*, or the idea that recursive biological and technological improvement has the potential to radically redefine what it means to be human, including perhaps the elimination of inequality among people and possibly also among species (e.g. Eden, Moor, Søraker, & Steinhart, 2012).

There are significant reasons to be skeptical of these technological prophecies, however. Gene editing/manipulation techniques fall broadly into the category of *second-wave eugenics* (Woodley of Menie, 2020) and are often promoted by, or are implicitly harmonious with, a libertarian ethical framework, that is, one that makes central the role of personal choice in selection for offspring characteristics (e.g. Agar, 2004; Anomaly, 2018). These techniques are also (generally) feasible, in that the science of genomics as applied to significant traits such as intelligence is sufficiently advanced at present to theoretically permit crude forms of embryo selection that would enhance *g* in offspring to some degree (polygenic scores for educational attainment and *g* can currently account for nearly 10% of the variance in *g* among representatively sampled individuals, which is not trivial; Lee et al., 2018). Advances are being made in identifying genetic variants responsible for pathological-range personality variation as well (e.g. Lo et al., 2017).[3]

While such personal reproductive choice may (and currently does) help reduce the prevalence of genetic diseases (amniocentesis and selective abortion have had the effect of reducing the prevalence of Down's syndrome in certain populations for example; de Graaf, Buckley, & Skotko, 2015), major regulatory barriers currently exist in Western populations (in particular) that are unlikely to be much altered in a way that will be permissive of some kind of marketized reproductive-genetic engineering. Indeed, part of the problem may stem from the fact that certain fashionable moral/ethical views have severely attenuated support for "genetic enhancement" by changing perceptions of the value of different phenotypes. The attitude that, for example, high levels of intelligence are more valuable than low ones may in part be a consequence of historical group-selective pressures favoring those groups with the largest numbers of intelligent, industrious individuals and "genius" innovators (Woodley of Menie, Figueredo, et al., 2017). Under a regime of individual-level selection, it is easier to convince people of the value-equality of different levels of traits, absent strong ecological sorting of phenotypes as a function of their fitness payoffs to the group. Furthermore, an ecology of virtue signaling can arise from the phenocopying of axiological attitudes that elite carriers of spiteful mutations hold; this process may explain, at least in part, the modern phenomenon of some individuals ascribing equal value to objectively pathological and healthy phenotypes (consider, e.g. Szasz, 2010).

From such a severely altered social-epistatic ecology, virtues of a sort that promote further reductions of group-level fitness would be likely to emerge, which, if enmeshed with the power of gene-manipulation technologies, could unleash an epidemic of psychobehavioral pathology that would collapse a civilization very quickly. A good example of this may be imagined in the opportunity that freedom-of-choice genetic engineering might give individuals to deliberately select into their offspring traits associated with psychopathic tendencies (such as dominance and risk-taking facets of extraversion and heightened inter-personal manipulativeness[4]),

[3] The mind-uploading idea may depend on the assumption that the entirety of the human mind is ultimately physical, which is far from certain (see Barušs & Mossbridge, 2017).

[4] A study of how females rate the relative desirability of certain traits in hypothetical offspring indicates an overwhelming preference for extraversion (which includes facets related to social dominance and venturesomeness) and relatively little preference for intelligence and conscientiousness (Latham & von Stumm, 2017). One might find this pattern of preferences

which under a regime of individual-level selection may be strongly associated with success, for example, in the globalized corporate world (Brooks & Fritzon, 2016, found that as many as 1 in 5 corporate CEOs may exhibit psychopathic personalities—compared to a population prevalence of 1 in 100).

One of the very few people to realize the extreme danger of enmeshing personal-choice ethics with reproductive-genetic technologies was Raymond B. Cattell (1972, 1987), who saw that group selection was essential to maintaining the evolutionary viability of civilizations and to conditioning selection for traits that would further that viability:

> A group positively planning well for its future will employ all three of the [following]: (1) differential birth/death rates, (2) rhythms of segregation and well-chosen hybridization, and (3) creation of mutations along with genetic engineering…. These methods we need to use toward group goals to bring about by a collective movement of its citizens (a) survival of the group, and (b) launching out on its own evolutionary adventure. (Cattell, 1987, pp. 210–211; emphasis in original)

especially concerning in light of evidence that extraversion and intelligence are negatively genetically correlated (Bratko, Butkovic, Vukasovic, Chamorro-Premuzic, & Von Stumm, 2012), indicating that selection for extraversion runs the risk of selection against intelligence. In any case, this preference pattern is potentially consistent with the observation from evolutionary psychology that females respond to environmental and social cues by adaptively modulating their mate preferences (see, e.g. Del Giudice, 2011); contemporary Western women's preferences for offspring traits are logical, given that high intelligence and conscientiousness (see, e.g. Perkins, 2016; Skirbekk & Blekesaune, 2014) may not tend to benefit offspring fitness in those females' populations (indeed the former trait is quite robustly negatively associated with fertility in females and males [Reeve et al., 2018], although variation across regions and over time is apparent [Kolk & Barclay, 2019]). Moreover, while women certainly prefer status in male mates, and so indirectly prefer intelligent males, most evidence seems to indicate that women are not sexually attracted to high levels of intelligence per se (Gignac, Darbyshire, & Ooi, 2018).

It is conceivable that with the normalization and widespread availability of reproductive-genetic tools, these preferences could translate into population-genetic change in ways that lead to *runaway artificial selection* for exaggerated levels of individually selected traits that are pathological vis-à-vis the well-being and fitness of biocultural groups. One could argue that male preferences for offspring traits may offset any negative externalities of female preferences in the use of reproductive-genetic techniques. But between the large proportion of children born to single mothers in contemporary Western populations, and Western law and culture's favoring of female over male procreative choice and autonomy (Baskerville, 2017), this hypothetical offsetting would probably be negligible (and that is *assuming* that relevant male and female offspring trait preferences substantially differ at all).

Cattell's belief system was promoted under the rubric of *Beyondism*, a scientifically informed moral-ethical system of planned biocultural evolution, the function of which would be to use various techniques to enhance the flourishing of a group through the artificial selection of traits that were maximally conducive to inter-group competitiveness. The value system of Beyondism was to have a religious character, since it was derived from Galton's (1904) belief that "eugenic" virtues would have to replace religious ones in order for selection against socially desirable traits to be stopped or reversed. Importantly, Cattell saw that it would be necessary to instigate inter-group competition in order to sustain the value system of Beyondism.[5] Cattell's preferred method was a form of *cooperative competition*, whereby "like players in some greater more vital game than men usually play, cultural groups recognize that the maintenance of inter-group competition is indispensable to evolution and they agree to cooperate in whatever rules are necessary to maintain it in effective action" (Cattell, 1972, p. 86).

The consequences of losing in this "great game" would be extreme, however, amounting to nothing less than the "phasing out" of defeated biocultural groups (i.e. having the biocultural distinctiveness of groups eliminated through dismantling). Such a value system, while in theory solving the individual-level runaway artificial selection problem inherent in the libertarian ethics of second-wave eugenics, nevertheless makes Beyondism very unlikely to ever take root as a viable alternative to liberal and social democracy in the West, since it is seriously objectionable to many. The potential for mutually assured destruction among the hypothetical "players" of such a "great game" makes efforts to stimulate inter-group rivalry and competition, even if done with some kind of oversight, fraught with existential risk.

Finally, a brief note on the status of radical life extension and mind emulation as prospective solutions. It is worth noting that these ideas are surrounded by hype that makes it difficult to determine whether real progress has been made toward the goal of realizing these technologies. Moreover, there are significant doubts about the scientific foundations of

[5] One might here think of Bruce Charlton's (2008) proposal to genetically engineer spiritual and religious values into people (a program that he terms *genospirituality*). This would probably have the effect of making populations more viable in inter-group conflict, given the historical role that religion seemingly played in rendering groups more fit for such conflict (see Chap. 3).

certain of these claims (for criticisms of the sufficiency of brain scanning for the purposes of reconstructing consciousness *in silico*, see Regalado, 2013). What is known, however, is that the rate of macro-innovation (major events in science and technology per year, per billion of the world's population) has been declining sharply since the mid-nineteenth century—the period in which the IQ-fertility correlation changed from positive to negative, or became dysgenic (Woodley of Menie, Figueredo, et al., 2017). It appears that dysgenic trends in *g* are making populations less innovative *despite* larger populations and prolonged and more universal exposure to schooling. The decline is even apparent in noted techno-optimist Ray Kurzweil's (1999) data on innovations in computing, when these are recomputed on a per capita basis, with most of the macro-innovation having occurred in the 1950s (the decade in which William Shockley invented the transistor; Huebner, 2005b). There is, then, little reason to believe that real and sustained progress toward effectively "sci-fi" technologies is occurring.

Biocosmic Pessimism

Finally, and admittedly more speculatively, is the possibility that the cyclical dynamics of civilization may be recurrent across advanced intelligences wherever they are found in the universe. The *Fermi paradox*, or sometimes *Fermi-Hart paradox* (Jones, 1985), results from the following assumptions and observation: life is relatively common in the galaxy (assumption) and some small subset of that life, beyond the human species, is intelligent enough to develop along space-faring lines (assumption); further, a great deal of time has elapsed since the origin of life on Earth (roughly 4.5 billion years; observation, or rather observation-based). From the foregoing, it is assumed that Earth should have been repeatedly colonized by waves of extraterrestrial expansion.[6] But the fact is that instead of a vast alien empire of colonized worlds teeming with intelligence, radio astronomers detect nothing but a *great silence* (Brin, 1983). So in brief, the Fermi-Hart paradox can be expressed with the following: "if they [advanced extraterrestrial

[6] Even assuming that these civilizations cannot expand into a galaxy very fast, given the ability to travel at only a relatively small fraction of the speed of light maximum, it should be possible for them to colonize all prospectively habitable worlds in a galaxy in a time-frame encompassing a couple of millions of years—in terms of cosmic timescales, this is a "blink of an eye" (Hart, 1975).

intelligences] exist, then they should be here already." The paradoxical finding that "they" are not here already has led to a cottage industry in solutions, which can be broadly aligned with the so-called *great filter* model (Hanson, 1998). The great filter is simply the idea that there are potential barriers that must be overcome on the path to advanced intelligence and beyond. Some argue that these barriers have been passed already (abiogenesis might be incredibly rare; unicellular living things, once originated might seldom make it to multicellularity; and multicellular life might seldom evolve into greater intelligence, etc.).

If these barriers have a cumulatively very low probability of being overcome, then it might be that life on Earth is a unique phenomenon—so the *rare earth hypothesis* might be true (Ward & Brownlee, 2000). Sources of life may exist in various places in the universe, but they may be thinly spread out across galaxies, which largely prevent different sources of life from coming into contact owing to the vast distances involved in intergalactic travel. Others argue that the filters may lie ahead of us in the form of *existential risks*, for example, nuclear war; natural disasters, such as asteroid strikes or stray gamma ray bursts; artificial intelligence (AI) uprisings; nanotech "gray goo" scenarios; and so on (Bostrom, 2002). Some have even argued that there are no great filters per se and that it is simply the case that older and significantly more advanced machine-phase civilizations are "aestivating"—that is, they have entered into states of quiescence, awaiting future cosmic eras when energetic and computational resources will be more numerous and colonization/expansion more thermodynamically favorable (Sandberg, Armstrong, & Cirkovic, 2017). Another possibility, consistent with the Singularity Hypothesis, is that ancient advanced civilizations inevitably "transcended" into an "inner space" or "a computationally optimal domain of increasingly dense, productive, miniaturized, and efficient scales of space, time, energy, and matter, and eventually, to a black-hole-like destination" (Smart, 2012, p. 55). Thus they simply operate at a physical level that is beyond the ability of less advanced civilizations to detect.

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A major belief among those who think that humanity is the sole advanced intelligent species in the galaxy, and has escaped the great filter, is that its destiny is to become a space-faring civilization and realize continual population growth. The solar system alone presents humanity with potentially millions of bodies that could be colonized and exploited for their raw materials. Efficient conversion of these resources into orbiting habitats could, with a sufficient density of these habitats englobing the sun (i.e. the construction of a Dyson "sphere," or rather swarm; Dyson, 1966), permit humanity to transition from a Kardashev (1964) Type-1 civilization (i.e. one able to use all of the available energy resources on Earth; note humanity is not currently at even that stage) to a Kardashev Type-2 one (able to use all of the energy output of the sun in order to sustain populations of quadrillions of humans). Beyond that is the possibility of becoming a truly galactic civilization at Kardashev Type 3, entailing the ability to use all of the resources available in all the star systems comprising a galaxy, allowing for human biomass to increase to uncountably high levels as humanity establishes itself as the dominant form of life in this part of the universe. To reiterate, rooted in this optimistic view of humankind's future is the belief in continual population growth; but as we have argued, strong negative selection and selection acting against those with low *g* and other traits that disfavor group fitness are necessary to *sustain* population growth, which had its roots in fierce inter-group competition during the Age of Empire (Figueredo et al., 2019).

We no longer have empires, we no longer have inter-group competition at the requisite level, and we no longer (perhaps mercifully) have differential mortality and fertility of the necessary degree. The Woodley effect and the probable high prevalence of spiteful mutations among elites have given rise to pathological norms that have likely undermined a biocultural fabric that took centuries of evolution to establish. We have already made the case that second-wave eugenics (see Anomaly, 2018) will not work, for even if it were readily taken up, it may yield the creation and dissemination of new psychobehavioral and possibly even biophysiologically pathological forms, the existence of which could in some instances break certain fundaments of our adaptive structuring. The evident inability of the West under dysgenic and relaxed negative selection to sustain its biomass does not augur well for its prospects as a space-faring civilization. Such a civilization would have to coordinate the vastly complex social ecologies that might emerge from the eventual transition into a Kardashev Type-2 civilization involving quadrillions of humans in the solar system.

Chronically low birth rates and collapsing fertility potential, coupled with (and partly a function of) the rise of atheism and other nihilisms, are currently driving the most techno-economically advanced civilizations on Earth into collapse, and their present biomass is but a drop in the ocean of the population size needed to sustain a Kardashev Type-2 civilization. We posit that the interorganismal pleiotropic effects of spiteful mutations scale in proportion to the size of the social-epistatic network and their opportunity to target it (Woodley of Menie, Figueredo, et al., 2017), which in turn scales, probably exponentially, with population biomass and social complexity. Imagine the size of the target for these mutations presented by a civilization of quadrillions of heavily interdependent and technologically sophisticated humans. Human social complexity undoes itself under the weight of its own biocultural failings, and groups that have undergone this complexification process rapidly scale back into small-population-size Malthusianism, as happened following the Roman Empire and the Islamic Golden Age of centuries past (Dutton & Woodley of Menie, 2018). That the same thing is happening to the contemporary West indicates that we may be passing through the great filter *right now*.

As a solution to the Fermi-Hart paradox, an objection to the SEAM may be raised on the grounds that assuming the possible existence of many other intelligences in the galaxy, could not such intelligences have essentially inscrutable natures, being bound by essentially alien evolutionary principles? Also, assuming some at least superficial similarities, why has not a single one of them instituted some draconian Beyondism-like policy, and by virtue of intense group selection, both among themselves and possibly other alien civilizations encountered during the inter-stellar colonization phase, managed (either in whole or in part) to avoid spiteful mutational meltdown or some other dysgenic existential risk? After all, it would only take one intelligence either adaptively optimized or bioengineered for conquest to spoil our proposed solution (such an intelligence would be here already after all, as per Fermi and Hart).

One possible explanation may relate to convergent evolution—that is the ability for different species that share no (recent) common ancestry to evolve along extremely similar lines morphologically as a function of their occupying very similar ecological niches. A classic example of this is in ichthyosaurs and modern-day cetaceans, which occupied very similar marine niches and even closely resemble one another in terms of morphology, despite having no recent common ancestry (Conway Morris, 1998). Examples of convergent evolution abound in nature and are far more numerous than once thought (Conway Morris, 2004). Convergent evolution is not restricted to the species-morphology level either. There are examples of genetic convergent evolution, involving identical genes arising completely independently of common descent (Stern, 2013); additionally, convergent evolution has been observed at the level of ecological communities, with entire assemblages of species interacting with one another in ways that are highly similar across assemblages in different biomes (Melville, Harmon, & Losos, 2006). Simon Conway Morris (2004, 2017) has even proposed what could be termed a *rash dictum*: So ubiquitous is convergent evolution on Earth that there is reason to predict that given similar initial conditions, different sources of life on different planets may end up convergently evolving to the point that they will be strongly recognizable to one another as intelligent life, possessing similar evolved biological features. Extending Conway Morris' rash dictum even further, into the realm of *xenopsychology* (Freitas Jr, 1984), the parallelisms may not end there, but may be reflected in convergent modes of social and cultural organization (Flores Martinez, 2014) and so in the convergent susceptibility of particularly complex social organization, arising from relaxed negative selection, to spiteful mutations.

If the convergence principle extends to the level of xenopsychological organization, then it strengthens the view that the SEAM identifies a source of the great silence. Civilizations throughout the galaxy consistently come to embrace nihilistic values and undergo decline, which prevents them from ever being able to comprehend the problem (at the level of civilizations), which in turn inhibits them from taking any kind of meaningful (i.e. group-focused and collective) action to mitigate the problem, perhaps especially because sustainment of large populations seems to require an enhancement of prosociality that softens, so to speak, treatment of others (Norenzayan & Shariff, 2008; Purzycki et al., 2016), which might be redirected in pathological ways through the effects of deleterious mutations. Resultant technological and economic decline from these genetically based trends then leads these convergently doomed civilizations to collapse back into Malthusianism, restarting the civilizational cycle.

Another fascinating, and highly controversial implication of Conway Morris' rash dictum, is parallelism in time of inter-planetary civilizational development. We may be living in a special cosmological era characterized by chemical and energetic conditions that are especially suitable for the emergence of life, or even for the transfer of life from one origin planet to another via panspermia (Steele et al., 2018). This may be a consequence of humanity's having evolved in the *stelliferous era*, in which matter is structured into stars, galaxies, and super-clusters, with stellar nucleosynthesis serving as the primary form of energy generation and source of "metals" (elements with atomic numbers ≥ two)

(Adams & Laughlin, 1999). It might even be predicted that a subset of this era has been especially conducive to the emergence and evolution of life, perhaps by virtue of the presence of especially optimal structure, energy, and proportions of various elements. This hypothetical period could be termed the *viviferous subera*. Consequently, we may share a galaxy along with other advanced intelligences, which all evolved from life that originated within the relatively narrow window of time that might characterize the *viviferous subera* (which may simply cover the 0.5- to 1-billion-year period in which life arose on Earth), essentially developing in parallel with one another, each trapped in its own cycles of time, and so unable to spread beyond the confines of its home system. One tantalizing but highly controversial piece of evidence for this comes from the research of Trottier and Borra (2016), who examined the spectra of 2.5 million F2 to K1 range (solar-like) stars, finding indications among a subset of 234 of them of modulated pulses of light using a Fourier transform that may have an artificial source (specifically a laser orbiting the star) (for opposing views, see Isaacson et al., 2018; Tamburini & Likarta, 2017). This method had previously been theorized as an excellent way to signal between stars (Borra, 2010) and, in terms of human technological capacities, is not much beyond what we can do at present (Borra, 2012); indeed it was this theoretical work that inspired the sky survey in question.

If we are in fact detecting "beacons" of other civilizations, not separated too far from us in time, what we may be seeing is the *technological plateau*—the point beyond which no civilization has been able to advance before collapsing, a point that may not be much further down the road technologically from where human civilization is at present. The duration of technological Dark Ages that succeed such collapses (hundreds or even thousands of years; Huebner, 2005b) furthermore heightens the vulnerability of those populations—which may eventually reacquire lost civilization by virtue of fortuitous biocultural evolution—to existential risks of the natural-hazards variety (e.g. and as indicated before, an asteroid strike, stray gamma ray burst, or caldera eruption). These phenomena could end the civilizational cycle on Earth permanently. If this scenario holds for all intelligent life in the universe, then it gives us pause, and reason to be ultimately pessimistic about our own future as a species.

References

Abdellaoui, A., Hugh-Jones, D., Yengo, L., Kemper, K. E., Nivard, M. G., Veul, L., … Visscher, P. M. (2019). Genetic correlates of social stratification in Great Britain. *Nature Human Behaviour*, in press. https://doi.org/10.1038/s41562-019-0757-5

Adams, F., & Laughlin, G. (1999). *The five ages of the universe: Inside the physics of eternity*. New York, NY: Free Press Publishers.

Agar, N. (2004). *Liberal eugenics: In defense of human enhancement*. London: Blackwell Publishing.

Anomaly, J. (2018). Defending eugenics: From cryptic choice to conscious selection. *Monash Bioethics Review, 35*, 24–35.

Banks, G. C., Batchelor, J. H., & McDaniel, M. A. (2010). Smarter people are (a bit) more symmetrical: A meta-analysis of the relationship between intelligence and fluctuating asymmetry. *Intelligence, 38*, 393–401.

Barušs, I., & Mossbridge, J. (2017). *Transcendent mind: Rethinking the science of consciousness*. Washington, DC: American Psychological Association.

Baskerville, S. (2017). *The new politics of sex: The sexual revolution, civil liberties, and the growth of governmental power*. New York, NY: Angelico Press.

Beauchamp, J. P. (2016). Genetic evidence for natural selection in humans in the contemporary United States. *Proceedings of the National Academy of Sciences, USA, 113*, 7774–7779.

Bongaarts, J. (2009). Human population growth and the demographic transition. *Philosophical Transactions of the Royal Society of London: Biological Science, 364*, 2985–2990.

Borra, E. F. (2010). Spectral signatures of ultra-rapidly varying objects in spectroscopic surveys. *Astronomy & Astrophysics, 511*, L6.

Borra, E. F. (2012). Searching for extraterrestrial intelligence signals in astronomical spectra, including existing data. *The Astronomical Journal, 144*, 181.

Bostrom, N. (2002). Existential risks: Analyzing human extinction scenarios and related hazards. *Journal of Evolution & Technology, 9*. Retrieved from http://www.jetpress.org/volume9/risks.html

Bratko, D., Butkovic, A., Vukasovic, T., Chamorro-Premuzic, T., & Von Stumm, S. (2012). Cognitive ability, self-assessed intelligence and personality: Common genetic but independent environmental aetiologies. *Intelligence, 40*, 91–99.

Brin, G. D. (1983). The 'Great Silence': the controversy concerning extraterrestrial intelligent life. *Quarterly Journal of the Royal Astronomical Society, 24, 283–309.*

Brooks, N., & Fritzon, K. (2016). Psychopathic personality characteristics amongst high functioning populations. *Crime Psychology Review, 2*, 22–44 [*Note: This paper was officially retracted on 16/07/2017 owing to a plagiarism issue. The data, however, are not in question, hence reference can be made to the paper despite subsequent retraction*].

Calhoun, J. B. (1973). Death squared: The explosive growth and demise of a mouse population. *Proceedings of the National Academy of Sciences, USA, 66*, 80–88.

Carroll, J. B. (1993). *Human cognitive abilities: A survey of factor-analytic studies*. Cambridge, UK: Cambridge University Press.

Cattell, R. B. (1937). *The fight for our national intelligence*. London, UK: P. S. King & Son, Ltd.

Cattell, R. B. (1950). The fate of national intelligence: Test of a thirteen-year prediction. *The Eugenics Review, 42*, 136–148.

Cattell, R. B. (1972). *A New morality from science: Beyondism*. New York: Pergamon.

Cattell, R. B. (1987). *Beyondism: Religion from science*. Westport, CT: Praeger.

Charlton, B. G. (1997). The inequity of inequality. *Journal of Health Psychology, 2*, 413–425.

Charlton, B. G. (2008). Genospirituality: Genetic engineering for spiritual and religious enhancement. *Medical Hypotheses, 71*, 825–828.

Clark, G. (2007). *A farewell to alms: A brief economic history of the world*. Princeton, NJ: Princeton University Press.

Clark, G. (2014). *The son also rises: Surnames and the history of social mobility*. Princeton, NJ: Princeton University Press.

Conley, D., Laidley, T., Belsky, D. W., Fletcher, J. M., Boardman, J. D., & Domingue, B. J. (2016). Assortative mating and differential fertility by phenotype and genotype across the 20th century. *Proceedings of the National Academy of Sciences, USA, 113*, 6647–6652.

Conway Morris, S. (1998). *The crucible of creation: The burgess shale and the rise of animals*. New York, NY: Oxford University Press.

Conway Morris, S. (2004). *Life's solution: Inevitable humans in a lonely universe*. Cambridge, UK: Cambridge University Press.

Conway Morris, S. (2017). Three explanations for extraterrestrials: Sensible, unlikely, mad. *International Journal of Astrobiology, 17*, 1–7.

de Graaf, G., Buckley, F. F., & Skotko, B. G. (2015). Estimates of the live births, natural losses, and elective terminations with down syndrome in the United States. *American Journal of Medical Genetics Part A, 167A*, 756–767.

Del Giudice, M. (2011). Sex ratio dynamics and fluctuating selection on personality. *Journal of Theoretical Biology, 297*, 48–60.

Dutton, E., & van der Linden, D. (2015). Who are the "Clever Sillies"? The intelligence, personality, and motives of clever silly originators and those who follow them. *Intelligence, 49*, 57–65.

Dutton, E., & Woodley of Menie, M. A. (2018). *At our wit's end: Why we're becoming less intelligent and what it means for the future*. Exeter, UK: Imprint Academic.

Dyson, F. (1966). The search for extraterrestrial technology. In R. E. Marshak (Ed.), *Perspectives in modern physics* (pp. 641–655). New York, NY: Wiley.

Eden, A. H., Moor, J. H., Søraker, J. H., & Steinhart, E. (Eds.). (2012). *Singularity hypothesis: A scientific and philosophical assessment*. New York, NY: Springer.
Figueredo, A. J., Peñaherrera-Aguirre, M., Fernandes, H. B. F., Lomayesva, L., Woodley of Menie, M. A., Hertler, S. C., Sarraf, M. A. (2019). The ecology of empire: The dynamics of strategic differentiation-integration in two competing Western European biocultural groups. *Politics and the Life Sciences*. https://doi.org/10.1017/pls.2019.12 (in press)
Flores Martinez, C. L. (2014). SETI in the light of cosmic convergent evolution. *Acta Astronautica, 104*, 341–349.
Freitas, R. A., Jr. (1984). Xenopsychology. *Analog Science Fiction/Science Fact, 104*, 41–53.
Galor, O. (2012). The demographic transition: Causes and consequences. *Cliometrica, 6*, 1–28.
Galton, F. (1869). *Hereditary genius*. London: Macmillan.
Galton, F. (1904). Eugenics: Its definition, scope, and aims. *American Journal of Sociology, 10*, 1–25.
Gignac, G. E., Darbyshire, J., & Ooi, M. (2018). Some people are attracted sexually to intelligence: A psychometric evaluation of sapiosexuality. *Intelligence, 66*, 98–111.
Hanson, R. (1998). *The great filter – Are we almost past it?* Retrieved from http://mason.gmu.edu/~rhanson/greatfilter.html
Hart, M. H. (1975). Explanation for the absence of extraterrestrials on Earth. *Quarterly Journal of the Royal Astronomical Society, 16, 128–135.*
Higgins, J. V., Reed, E. W., & Reed, S. C. (1962). Intelligence and family size: A paradox resolved. *Eugenics Quarterly, 9*, 84–90.
Hill, W. D., Arslan, R. C., Xia, C., Luciano, M., Amador, C., Navarro, P., … Penke, L. (2018). Genomic analysis of family data reveals additional genetic effects on intelligence and personality. *Molecular Psychiatry, 23*, 2347–2362.
Huebner, J. (2005a). A possible declining trend for worldwide innovation. *Technological Forecasting & Social Change, 72*, 980–986.
Huebner, J. (2005b). Response by the authors. *Technological Forecasting & Social Change, 72*, 995–1000.
Isaacson, H., Siemion, A. P. V., Marcy, G. W., Hickish, J., Price, D. C., Enriquez, J. E., & Gizani, N. (2018). Evidence of claimed periodic spectral modulations in high-resolution optical spectra of nearby stars. *Publications of the Astronomical Society of the Pacific, 131*, 995.
Jones, E. M. (1985). *"Where is everybody?" An account of Fermi's question*. Los Alamos National Laboratory. *LA-10311-MS, UC-34B.*
Kardashev, N. (1964). Transmission of information by extraterrestrial civilizations. *Soviet Astronomy, 8*, 217.

Kolk, M., & Barclay, K. (2019). Cognitive ability and fertility among Swedish men born 1951–1967: Evidence from military conscription registers. *Proceedings of the Royal Society B: Biological Sciences, 286*, 20190359.

Kong, A., Banks, E., Poplin, R., Garimella, K. V., Maguire, J. R., … Daly, M. J. (2017). Selection against variants in the genome associated with educational attainment. *Proceedings of the National Academy of Sciences, USA, 114*, E727–E732.

Kurzweil, R. (1999). *The age of spiritual machines: When computers exceed human intelligence*. New York, USA: Viking Press.

Kurzweil, R. (2004). *The singularity is near: When humans transcend biology*. New York, NY: Viking Press.

Latham, R. M., & von Stumm, S. (2017). Mothers want extraversion over conscientiousness or intelligence for their children. *Personality and Individual Differences, 119*, 262–265.

Lee, J. J., Wedow, R., Okbay, A., Kong, O., Maghzian, M., … Cesarini, D. (2018). Gene discovery and polygenic prediction from a 1.1-million-person GWAS of educational attainment. *Nature Genetics, 50*, 1112–1121.

Lo, M. T., Hinds, D. A., Tung, J. Y., Franz, C., Fan, C. C., … Chen, C. H. (2017). Genome-wide analyses for personality traits identify six genomic loci and show correlations with psychiatric disorders. *Nature Genetics, 49*, 152–156.

Loehlin, J. C. (1997). Dysgenesis and IQ. *American Psychologist, 52*, 1236–1239.

Lynn, R. (1996). *Dysgenics: Genetic deterioration in modern populations.* Westport, CT: Praeger.

MacDonald, K. B. (2009). Evolution, psychology, and a conflict theory of culture. *Evolutionary Psychology, 7*, 208–233.

Madison, G., Woodley of Menie, M. A., & Sänger, J. (2016). Secular slowing of auditory simple reaction time in Sweden (1959–1985). *Frontiers in Human Neuroscience, 10*, 407.

Melville, J., Harmon, L. J., & Losos, J. B. (2006). Intercontinental community convergence of ecology and morphology in desert lizards. *Proceedings of the Royal Society B: Biological Science, 273*, 557–563.

Murray, C. (2003). *Human accomplishment: The pursuit of excellence in the arts and sciences, 800 BC to 1950.* New York, NY: Harper Collins.

Norenzayan, A., & Shariff, A. F. (2008). The origin and evolution of religious prosociality. *Science, 322*, 58–62.

Perkins, A. (2016). *The welfare trait: How state benefits affect personality.* Basingstoke, UK: Palgrave Macmillan.

Pietschnig, J., & Gittler, G. (2015). A reversal of the Flynn effect for spatial perception in German-speaking countries: Evidence from a cross-temporal IRT-based meta-analysis (1977–2014). *Intelligence, 53*, 145–153.

Pietschnig, J., & Gittler, G. (2017). Is ability-based emotional intelligence impervious to the Flynn effect? A cross-temporal meta-analysis (2001–2015). *Intelligence, 61*, 37–45.

Pietschnig, J., & Voracek, M. (2015). One century of global IQ gains: A formal metaanalysis of the Flynn effect (1909–2013). *Perspectives on Psychological Science, 10*, 282–306.

Purzycki, B. G., Apicella, C., Atkinson, Q. D., Cohen, E., McNamara, R. A., Willard, A. K., … Henrich, J. (2016). Moralistic gods, supernatural punishment and the expansion of human sociality. *Nature, 530*, 327–330.

Reeve, C. L., Heeney, M. D., & Woodley of Menie, M. A. (2018). A systematic review of the state of the literature relating parental general cognitive ability and number of offspring. *Personality and Individual Differences, 134*, 107–118.

Regalado, A. (2013). The brain is not computable. A leading neuroscientist says Kurzweil's Singularity isn't going to happen. Instead, humans will assimilate machines. *MIT Technology Review*. Retrieved from https://www.technologyreview.com/s/511421/the-brain-is-not-computable/

Rindermann, H. (2018). *Cognitive capitalism: Human capital and the wellbeing of nations*. Cambridge, UK: Cambridge University Press.

Sandberg, A., Armstrong, S., & Cirkovic, M. M. (2017). That which is not dead can eternal lie: The aestivation hypothesis for resolving Fermi's paradox. Retrieved from https://arxiv.org/abs/1705.03394

Sarraf, M. (2017). Review of historical variability in heritable general intelligence: Its evolutionary origins and sociocultural consequences. *Personality and Individual Differences, 109*, 238–241.

Skirbekk, V. (2008). Fertility trends by social status. *Demographic Research, 18*, 145–180.

Skirbekk, V., & Blekesaune, M. (2014). Personality traits increasingly important for male fertility: Evidence from Norway. *European Journal of Personality, 28*, 521–529.

Smart, J. M. (2012). The transcension hypothesis: Sufficiently advanced civilizations invariably leave our universe, and implications for METI and SETI. *Acta Astronautica*, *78*, 55–68.

Spearman, C. (1904). General intelligence, objectively determined and measured. *American Journal of Psychology, 15*, 201–293.

Steele, E. J., Al-Mufti, S., Augustyn, K. A., Chandrajith, R., Coghlan, J. P., … Liu, Y. (2018). Cause of the Cambrian Explosion – Terrestrial of cosmic? *Progress in Biophysics & Molecular Biology, 136*, 3–23.

Stern, D. L. (2013). The genetic causes of convergent evolution. *Nature Reviews Genetics, 14*, 751–764.

Szasz, T. S. (2010). *The myth of mental illness: Foundations of a theory of personal conduct* (Anniversary ed.). New York, NY: Harper Perennial.

Tamburini, F., & Likarta, I. (2017). Can the periodic spectral modulations observed in 236 Sloan Sky Survey stars be due to dark matter effects? *Physica Scripta, 92*, 095001.

te Nijenhuis, J., & van der Flier, H. (2013). Is the Flynn effect on *g*? A meta-analysis. *Intelligence, 41*, 802–807.
Trahan, L., Stuebing, K. K., Hiscock, M. K., & Fletcher, J. M. (2014). The Flynn effect: A meta-analysis. *Psychological Bulletin, 140*, 1332–1360.
Trottier, E., & Borra, E. F. (2016). Discovery of peculiar periodic spectral modulations in a small fraction of solar-type starts. *Publications of the Astronomical Society of the Pacific, 128*, 114201.
van Bloois, R. M., Geutjes, L. L., te Nijenhuis, J., & de Pater, I. E. (2009). *g loadings and their true score correlations with heritability coefficients, giftedness, and mental retardation: Three psychometric meta-analyses.* Paper presented at the 10th Annual Meeting of the International Society for Intelligence Research, Madrid, Spain, December.
Voronin, I., te Nijenhuis, J., & Malykh, S. B. (2016). The correlation between *g* loadings and heritability in Russia. *Journal of Biosocial Science, 48*, 833–843.
Ward, P., & Brownlee, D. E. (2000). *Rare Earth: Why complex life is uncommon in the universe.* Göttingen, Germany: Copernicus Publishers.
Weiss, V. (2007). The population cycle drives human history from a eugenic phase into a dysgenic phase and eventual collapse. *Journal of Social, Political, & Economic Studies, 32*, 327–358.
Wicherts, J. M., Dolan, C. V., Oosterveld, P., Hessen, D. J., van Baal, G. C. M., … Span, M. A. (2004). Are intelligence tests measurement invariant over time? Investigating the nature of the Flynn effect. *Intelligence, 32*, 509–537.
Wongupparaj, P., Wongupparaj, R., Kumari, V., & Morris, R. G. (2017). The Flynn effect for verbal and visuospatial short-term and working memory: A cross-temporal meta-analysis. *Intelligence, 64*, 71–80.
Woodley, M. A. (2010). Are high-IQ individuals deficient in common sense? A critical examination of the 'clever sillies' hypothesis. *Intelligence, 38*, 471–480.
Woodley, M. A., & Figueredo, A. J. (2013). *Historical variability in heritable general intelligence: Its evolutionary origins and socio-cultural consequences.* Buckingham, UK: Buckingham University Press.
Woodley of Menie, M. A. (2015). How fragile is our intellect? Estimating losses in general intelligence due to both selection and mutation accumulation. *Personality and Individual Differences, 75*, 80–84.
Woodley of Menie, M. A. (2016). Consideration of cognitive variance components potentially solves Beauchamp's paradox. *Proceedings of the National Academy of Sciences, USA, 113*, E5780–E5781.
Woodley of Menie, M. A. (2020). Eugenics movement. In V. Zeigler-Hill & T. K. Shackelford (Eds.), *Encyclopedia of personality and individual differences.* New York, NY: Springer. https://doi.org/10.1007/978-3-319-28099-8_750-1
Woodley of Menie, M. A., Cabeza de Baca, T., Fernandes, H. B. F., Madison, G., & Figueredo, A. J. (2017). Slow and steady wins the race: *K* positively predicts fertility in the USA and Sweden. *Evolutionary Psychological Science, 3*, 109–117.

Woodley of Menie, M. A., & Fernandes, H. B. F. (2015). Do opposing secular trends on backwards and forwards digit span evidence the co-occurrence model? A comment on Gignac (2015). *Intelligence, 50*, 125–130.
Woodley of Menie, M. A., & Fernandes, H. B. F. (2016a). Showing their true colours: Possible secular declines and a Jensen effect on color acuity – More evidence for the weaker variant of Spearman's other hypothesis. *Personality and Individual Differences, 88*, 280–284.
Woodley of Menie, M. A., & Fernandes, H. B. F. (2016b). The secular decline in general intelligence from decreasing developmental stability: Theoretical and empirical considerations. *Personality and Individual Differences, 92*, 194–199.
Woodley of Menie, M. A., Fernandes, H. B. F., Figueredo, A. J., & Meisenberg, G. (2015). By their words ye shall know them: Evidence of genic selection against general intelligence and concurrent environmental enrichment in vocabulary usage since the mid 19th century. *Frontiers in Psychology, 6*, 361.
Woodley of Menie, M. A., Fernandes, H. B. F., Kanazawa, S., & Dutton, E. (2018). Sinistrality is associated with (slightly) lower general intelligence: A data synthesis and consideration of the secular trend in handedness. *HOMO: Journal of Comparative Human Biology, 69*, 118–126.
Woodley of Menie, M. A., Figueredo, A. J., Sarraf, M. A., Hertler, S. C., Fernandes, H. B. F., & Peñaherrera-Aguirre, M. (2017). *The rhythm of the west: A biohistory of the modern era AD 1600 to the present*. Journal of Social Political and Economic Studies, Monograph Series, No. 37. Washington, DC: Council for Social and Economic Studies.
Woodley of Menie, M. A., Rindermann, H., Pallesen, J., & Sarraf, M. A. (2019). How intelligence affects fertility 30 years on: Retherford and Sewell revisited – With polygenic scores and numbers of grandchildren. *Twins Research & Human Genetics, 22*, 147–153.
Woodley of Menie, M. A., Sarraf, M. A., Peñaherrera-Aguirre, M., Fernandes, H. B. F., & Becker, D. (2018). What caused over a century of decline in general intelligence? Testing predictions from the genetic selection and neurotoxin hypotheses. *Evolutionary Psychological Science, 4*, 272–284.
Woodley of Menie, M. A., Schwartz, J. A., & Beaver, K. M. (2016). How cognitive genetic factors influence fertility outcomes: A mediational SEM analysis. *Twin Research & Human Genetics, 19*, 628–637.
Woodley of Menie, M. A., te Nijenhuis, J., & Murphy, R. (2015). The Victorians were still faster than us. Commentary: Factors influencing the latency of simple reaction time. *Frontiers in Human Neuroscience, 9*, 452.
Zhang, D. D., Lee, H. F., Wang, C., Li, B., Pei, Q., Zhang, J., & An, Y. (2011). The causality analysis of climate change and large-scale human crises. *Proceedings of the National Academy of Sciences, 108*, 17296–17301.