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# Expansion, Fission, and Decline: England and Anglo America

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## 1 Introduction

In 2017, our research team produced a technical, statistically-driven, monograph entitled *The Rhythm of the West: A Biohistory of the Modern Era, AD 1600 to the Present*. Therein, general intelligence, life history, and other topics were treated alongside multilevel selection theory. Here, after providing a general overview for the sake of context, we extract findings and discussion points from *The Rhythm of the West* directly relevant to demonstrating the reality of group selection within the history of the Britannic peoples. In a colloquial and qualitative manner, displaying essential analyses and separated from ancillary topics, we explain the dynamics of multilevel selection among the Britannic peoples as they have transitioned through stages of expansion, fission, and decline. Wealth, cognitive capacity, subjective well-being, poverty, and longevity are among the oblique markers of civilizational pulse. These correlate with, and are corroborated by, demographic decline. Declining evolutionary pressures for group-selected behaviors within mild industrial and postindustrial environments, operating for generations, have had a causal role in population decline, both in absolute and relative terms. To describe



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and explain the aforementioned decline, we review a variety of changes to Europe's *Early Modern Era* selective regime, including climatic changes during the *Little Ice Age*, niche expansion and modification during the Age of Exploration, nutritional advances gained during the *British Agricultural Revolution*, and technological advances gained during the *Industrial Revolution*.

## 2 Malthusianism: A Temporary Respite

Writing at the very end of the eighteenth century, Malthus correctly describes historical demographic trends, thereafter documented by economic historian David Hackett Fischer (1996), who found population growth to be the primary driver of *price revolutions*, characterized by decreasing returns to labor, rising inequality, increasing costs of necessary commodities, augmented crime, as well as strain to family units and the general social order. Fischer's price revolutions, in turn, are reminiscent of Turchin's (2016) applications of *Structural Demographic Theory*. Though a cleric, Malthus wrote against the scriptural injunction to be *fruitful and multiply*, for he saw, as did Fischer and Turchin after him, how increasing population can quickly tax available resources. He is famous for comparing the *arithmetical* rate of resource growth with the *geometric* rate of population growth, doing the world the service of highlighting the consequences of the contrast. However, classic Malthusian constraints characterized societies existing prior to the mid-eighteenth century, and times further past, but not those of late modernity, as we noted in Woodley of Menie et al. (2017):

> With respect to Malthusian fears, at least in the West, agricultural yields outstripped population growth, not the other way around (Mayhew, 2014)—or as Winch (1992, p. xxxi) put it, "the tortoise of food production overtook the hare of population growth," resulting in a rising tide of prosperity. The world did not become Easter Island writ large. In consequence, Malthusian predictions were [putatively] denuded of credibility, like an unfulfilled biblical prophecy. (p. 12)

As in the last sentence in the quote above, Malthus is often unjustly depicted as being proven wrong as a prognosticator, and even as a promulgator of general sociodemographic principles, in light of the nearly sustained global growth taking place within the last 200 years.[1] In spite of criticism, it may well be that he was never controverted, but simply unfortunate in the timing of his publication, as just then selective pressures were temporarily altered, and populations rapidly expanded without the catastrophic consequences previously foreseen. The temporal divide between the Malthusian past and the Modern present closely coincides with the 1798 publication of *An Essay on the Principle of Population*. In turn, the broad significance of this study is traceable to some few decades just before and after, as from thence came spectacular changes in the realized carrying capacity, the global population, and the prevailing selective regime. In subsequent sections leading up to our analyses, we review climatic warming, the impact of colonial expansion, agricultural advances, industrialization, and related developments allowing the carrying capacity to be raised rapidly in the nineteenth and twentieth centuries, before explaining how these features collectively altered prevailing selective regimes, which in turn, not only enabled sustained numeric growth but changed the composition of societies.

## 3 Climate Change

Following the generous climatic conditions of the *Medieval Warm Period*, marked by high gothic devotional cathedrals, the *Little Ice Age*, reigning from the fourteenth to nineteenth centuries[2] (Fagan, 2000), witnessed a drop in global mean annual temperatures (Mann et al., 2009) along with glacial advances (Grove, 2019). As per some estimates based upon varying criteria, the Little Ice Age lasted until the *middle* to *late* nineteenth century (e.g., Fagan, 2000). However, the *beginning* of the nineteenth century was the inflection point at which the current trend of global warming was initiated. This inflection point occurred roughly after 1816, the *year without a summer*, which killed 65,000 Europeans. This final major cold blast of the Little Ice Age was attributable to volcanism, which reduced insolation, making an already cold climate colder. It took some decades after that for temperatures to recover from the previous period of cold that started in the early fourteenth century, despite the upward trend, and this accounts for some of the differences in chronology. Prior to that, there was a high degree of variability around an otherwise nearly "flat" (or only minimally sloped) line extending between the middle of the fourteenth and the beginning of the nineteenth century.

During the Little Ice Age, traditional agriculture in Europe was severely and repeatedly disrupted (Fagan, 2000). Just as tree ring growth was slowed (White, 2013), there was a corresponding effect on agricultural output due to this period's reduced growing seasons and restricted crop yields, both of which are reflected in agricultural prices in England (Cressy, 2006). Across Europe at large, there were no less than 30 major famines[3] before the aforementioned 1816 inflection point: 1315–1317, the *Great Famine* throughout Europe; 1504, Spain; 1518, Venice, Italy; 1528, Languedoc, France; 1586, England; 1601–1603, Russia; 1601–1603, Estonia; 1618–1648, throughout Europe as a consequence of the Thirty Years' War; 1648–1660, Poland; 1649, Northern England; 1650–1652, Eastern France; 1651–1653, Ireland during Cromwell's conquest; 1670–1680, Spain; 1680, Sardinia, Italy; 1690, Scotland; 1693–1694, France; 1695–1697, Estonia and Livonia; 1695–1697, Sweden; 1696–1697, Finland; 1708–1711, East Prussia; 1709–1710, France; 1727–1728, England; 1740–1741, *Great Irish Famine*; 1764, Naples, Italy; 1770–1771, Czechia; 1771–1772, Saxony and Southern Germany; 1773, Sweden; 1783, Iceland; 1788, France just two years prior to the French Revolution; and 1811–1812, Madrid, Spain. Each of these famines, along with their associated plagues (as the malnourished become vulnerable to disease), took the lives of anywhere between tens of thousands to multiple millions.

The period of global warming spanning most of what historians call the Late Modern Era saw a gradual increase in crop yields, partially as a result of the more favorable climatic conditions for the growth of vegetation. This natural increase in biological productivity, however, was enhanced by two anthropogenic factors: (1) the British Agricultural Revolution and (2) the Industrial Revolution. Prior to reviewing the effects of either of these important revolutions, we first review the consequences of colonial expansion.

## 4 Expanding Ecological Niche Space in the Age of Exploration

Roughly contemporaneous with the Little Ice Age, Europe's *Early Modern Era* is bracketed by the Medieval Era on one side and the Industrial Revolution on the other. In ranging from the fifteenth century to the late eighteenth century, the Early Modern Era's beginning essentially coincides with the Fall of Constantinople to the Ottoman Turks in 1453. As the overland trade route between Europe and East Asia was thus closed due to domination by a hostile and expansionist imperial power, all European exploration, discovery, and colonization subsequent to that traumatic event were necessarily maritime. With traditional trade routes controlled by the Ottoman Turks, and pressed by the Little Ice Age's harsh cold to garner necessary resources through trade or conquest, Early Modern Europeans inaugurated the *Age of Exploration*, including both the explorations of Africa and Asia and the discovery and colonization of the Americas.

As we reviewed in our third chapter of *Life History Evolution: A Biological Meta-Theory for the Social Sciences*, this period saw a catastrophic change in the evolution of biogeographically regional *Symbiotic Portmanteau Assemblages* (SPAs),[4] which had hitherto proceeded mostly in mutual isolation. Ecologically, the European maritime expansions of the Early Modern Era saw the construction of an increasingly global network of "sea bridges," connecting all major biogeographical regions and their local SPAs. Through both intentional and unintentional transportation and exchange of human symbiota, this development put many regionally coevolved human-constructed SPAs of the world into direct contact and competition for the first time since the breakup of Pangaea. With the so-called Columbian exchange (Crosby, 1972), European explorers and colonizers transported *ecomorphs* originating in different SPAs, with cattle and horses grazing New World grasses, just as maize and potatoes grew in Old World soils. The term "ecomorph" (Williams, 1972; p. 72) denotes "species with the same structural habitat/niche, similar in morphology and behavior, but not necessarily close phyletically." Thus, ecomorphs, or species occupying the same or similar ecological niches, hitherto isolated by the Atlantic Ocean, came into direct competition during the Early Modern Era. Columbus' 1492 voyage began the invasion of Native American SPAs by Eurasian ecomorphs, but it also began the counter-invasion of Eurasian SPAs by Native American ecomorphs. Alternative SPAs contained functionally equivalent constructed niches for such *ecomorphs*. These mutual invasions of ecomorphs from different SPAs sometimes took the form of *competitive exclusion*, but other times took the form of *niche-splitting*, eventually evolving into *mutualisms*. Gause's (1932, 1934) *Law of Competitive Exclusion* states that two species competing for the same resources cannot coexist *sympatrically*,[5] as one will inevitably drive the other to local extinction. Grinnell (1904) had formulated the principle of competitive exclusion as follows: "Two species of approximately the same food habits are not likely to remain long evenly balanced in numbers in the same region. One will crowd out the other" (p. 377). MacArthur and Levins (1967) predicted that the ecological overlaps cannot exceed a certain *limiting similarity*, in which roughly ecomorphic species are too ecologically similar, selection will lead to *character displacement* and thereby exploitation of different resources. Character displacement is produced by selection against individuals occupying the zones of maximal overlap. *Niche-splitting* is synonymous with the terms *niche differentiation*, *niche segregation*, *niche separation*, and *niche partitioning* and refers to the process by which competing species use the environment differently in ways that permit them to coexist. Two species that differentiate their niches tend to compete less strongly.

The Columbian exchange (Crosby, 1972) therefore saw the creation of selectively "blended" Native American-Eurasian SPAs, with niche-splitting ecomorphs derived from both Eurasian SPAs and Native American SPAs. These associations evolved into mutualisms only after the *British Agricultural Revolution* of the late eighteenth century, with the development of highly bioproductive crop rotation methods, frequently involving mixed Old and New World cultivars. This later British Agricultural Revolution would not have been possible without the availability of these hybridized or "blended" SPAs. The early niche-splitting among ecomorphs derived from both Eurasian and Native American SPAs was made possible by the filling of vacant niches within each SPA by species from the other assemblage. For example, there were vacant microhabitats in Southern China and the Indonesian Archipelago that were not suitable for rice farming, but were suitable for the cultivation of New World sweet potatoes. In addition, the global cooling of the Northern Hemisphere during the Early Modern Era made it difficult, and in some cases impossible, to grow many traditional Old World cultivars in Northern Europe, freeing those niches for invasion by New World white potatoes.

## 5 The British Agricultural Revolution

According to Clark (2007), the intraspecific selection pressures on European populations during the Early Modern Era (or Little Ice Age) were quite severe and consequential. Until the early nineteenth century, the European upper classes produced over twice the number of surviving offspring than the European lower classes. These selective pressures altered the cognitive and conative characteristics of European populations in systematic ways by the mechanisms of gene-culture coevolution. For Clark, as famine and disease thinned the ranks of the impoverished classes, they were replaced in the population by the offspring of the wealthy. What Clark calls "middle-class values," such as nonviolence, literacy, and hard work, were thus spread throughout the population both culturally and genetically. Clark (2008) further argues that "the rich in pre-industrial England had to be different in personality and culture from the poor" (p. 16) and that consequently "the rich in modern industrial society are genetically different from the poor" (p. 19). Such differences must have been relevant to economic success and could have been passed on by culture, genetics, or a combination of the two.

Clark's (2007) theory is evolutionarily plausible, as every subsistence economy selects phenotypes (and, indirectly, genotypes) that are better suited to survival and reproduction under its defining "material conditions of existence" (Marx & Engels, 1848, p. 496). These selective pressures affect the evolution of regional populations of human and nonhuman animals alike, as well as their associated plants. These selective pressures also necessarily affect the coevolution of symbiotic human and nonhuman animals and plants, as these inevitably constitute part of each other's *adaptively relevant environments* (Irons, 1998).

According to Toffler's (1980) *Three Wave Theory*: (1) the First Wave is Agricultural Age Society, (2) the Second Wave is Industrial Age society, and (3) the Third Wave is Postindustrial Age Society. If Clark (2007) is correct, the new "Second Wave" mentality and vision of the world was thus favored by social selection, which Toffler (1980) has characterized as *indust-reality* (p. 97):

> The Second Wave Society is industrial and based on mass production, mass distribution, mass consumption, mass education, mass media, mass recreation, mass entertainment, and weapons of mass destruction. You combine those things with standardization, centralization, concentration, and synchronization, and you wind up with a style of organization we call bureaucracy.[6]

This industrialized worldview involved the *commodification* of the natural as well as social world. This commodification included all nonhuman animals and plants and also included other human animals (e.g., enslaved Africans). The commodification of the biological world naturally led to the direct selective breeding of nonhuman animals for more specific purposes than ever hitherto envisioned, as well as some expressed intentions and unsuccessful attempts (e.g., Eugenics movements) to apply similar principles to the "improvement" of human populations by means of artificial selection, based on traits presumably conferring social utility to the group (Woodley & Figueredo, 2013). Thus, the intensified, intentional, and directed artificial selection of nonhuman animals did not occur until the beginning of the Late Modern Era in Western civilization and was part and parcel of the industrialization process of European societies. There appears to be little evidence that it occurred at any time before then, at least on anything even remotely approaching the modern scale.

The Industrial Revolution actually began with the industrialization of agriculture, sometimes called the *British Agricultural Revolution* (AD ~1700–1850). This intensification of agricultural technologies was a direct response to the existential threats to European agriculture (and, hence, the food supply) posed by adverse climate change during the Little Ice Age. The necessary adaptations to European agricultural production practices created new selective pressures for different cognitive and conative phenotypes in the affected/afflicted populations.

The transformation of modern farming practices promoted by the British Agricultural Revolution was based on four pragmatic principles: (1) enclosure; (2) mechanization; (3) four-field crop rotation; and (4) selective breeding. Agriculture across Europe had previously been characterized by the feudal open field system, within which farmers worked on strips of land in fields they held in common. This was later viewed as "inefficient" and as reducing the individual incentive to improve productivity. British yeomen thus began to *enclose* and then optimize the use of *their* land. This process of land reform accelerated in the eighteenth century with special acts of the British Parliament expediting the consolidation of larger and *privately owned* holdings, encouraging experiments in increased productivity by more entrepreneurial *landowners*.

The second Viscount Charles Townshend (Frey & Frey, 2019) introduced the four-field crop rotation in the eighteenth century, and these new patterns of land use resulted in substantial expansions to the available area of arable land, producing both fodder crops and grazing crops that enabled livestock to be bred year-round. The use of nitrogen-rich manure and nitrogen-fixing crops, such as clover, increased yields of cereal crops by enhancing the amount of available nitrogen in the soil. This removed the major limiting factor on cereal production existing up until the early nineteenth century. For example, the productivity of wheat in England increased from approximately nineteen bushels per acre in 1720 to approximately thirty bushels per acre by 1840. The changes in agriculture implemented in Great Britain during this period subsequently affected agricultural practices around the world. These new agricultural technologies and cultivars multiplied yields per land unit to many times those produced in the Medieval Era.

Selective breeding of animals was also first established as a scientific practice during this historical period. For example, the second Viscount Robert Bakewell (see Wood, 1973) improved the Lincoln Longwool by the selective breeding of native sheep stock and later used it to develop the hornless and meatier Dishley Leicester. Bakewell was the first to breed cattle primarily for *beef*, as British cattle were previously kept mostly as *oxen* for pulling ploughs. To accomplish this, he crossed long-horned heifers with Westmoreland bulls. From this hybrid stock, he eventually developed the Dishley Longhorn, which he afterwards replaced with shorter-horned versions. Such innovations led to dramatic increases in the size and quality of farm animals. For example, the average weight of a bull sold for slaughter was 168 kg in 1700, but had more than doubled to 381 kg by 1786.

The British Agricultural Revolution brought about large excesses of calories that fueled dense settlements and allowed all manner of specializations to flourish. More could now become mechanics, inventors, scientists, naturalists, and chemists, being sated by agricultural surplus and liberated from directly working the land. In this way, the British Agricultural Revolution fostered the Industrial Revolution that further changed the selective regime and thus the carrying capacity of the environment.

## 6 The Industrial Revolution

*The Field and the Forge: Population, Production, and Power in the Pre-Industrial West*, written by John Maxwell Landers, draws on a distinction between *organic* and *mineral* economies. As reviewed in our seventh chapter of *Life History Evolution: A Biological Meta-Theory for the Social Sciences*, organic economies are defined by seasonal and agricultural rhythms and subject to subsistence living under Malthusian constraints. They impose temporal torpors, periods of inactivity imposed by seasonal cold and darkness. These organic societies were also limited in travel, trade, and war because all of these activities ultimately require fuel and energy, both of which are in short supply in organic societies. “Ultimately,” Landers (2003; p. 17) writes, “everything depended on the efficiency of plant photosynthesis and the energy conversion of biological ‘engines’, and both are low by mechanical standards.” From the scarcity of energy came restricted productivity, rendering scarce the provisions necessary to sustain and reproduce life. Laboring to keep dry, warm, and fed, the mass of the peasantry could not then contribute to economic diversification, arts, letters, and research, or otherwise stimulate the economy with demands for luxury goods. Undifferentiated societies, lacking in basic resources and existing amidst climatic variability and harshness, then phased into their opposites with the transition to mineral economies. On the cusp of industrialization, England had high labor rates and rich coal deposits, conditions fortuitously following the Enlightenment and its scientific revolution (Allen, 2009). Harnessing this power in blast furnaces and steam engines, Britons inaugurated an era of sustained growth, manifest in its expanding economy, territory, and population. The unprecedented excesses of energy unlocked from fossil fuels allowed work to be accomplished; such work allowed infrastructure, foodstuffs, and houses to be created that would not have otherwise existed.[7]

Relevant to this discussion, and that pursued in the subsequent section, Clark makes the point that, in 1800, the average European was saddled with material conditions that were in many ways worse than their hunter-gatherer counterparts, as measured by, for instance, longevity and material consumption. Yet, Clark insists that since then, industrialized countries have become ten or twenty times as wealthy as industrialization spread in earnest, with the main beneficiaries being the poor.[8] Fertility rates in pre-industrial Europe were low only because there was a late age for females marrying (between 24% and 26%), because some (between 10% and 25%) never married, and because there was a low (between 3% and 4%) illegitimacy rate, which implied that sex was largely confined to marriage. These reproductive restraints mark the continued operation of more or less Malthusian conditions, which became unrecognizable only when all foregoing factors combined with advanced industrialization. To this point, consider the following passage from Gat (2017):

> An exponential increase in wealth has been central to the rise of industrial-technological society. It has been fueled by a steep and continuous growth in per capita production and marked a sharp break from the Malthusian trap that characterized human history until then. Premodern increases in productivity were largely absorbed by population growth, leaving the vast majority of people in dire poverty, precariously close to subsistence level. With the outbreak of the industrial-technological revolution, however, that

> changed dramatically. Average growth in the industrial world has become about ten times faster than in pre-industrial times, with production per capita for the first time registering substantial and sustained real growth at an average annual rate of 1.5–2.0 percent. (p. 154)

It has been said that humans convert resources into offspring. So it was that after 1850, with the combined effects of climatic warming, adaptive introgressions from New World SPAs, and the British Agricultural and Industrial Revolutions, the ceiling on the carrying capacity rose dramatically, and the European population increased accordingly. Beyond simple increases in population, however, the diversification of social roles and economic specializations very importantly followed from population growth and energy inputs. With economic diversification, Ricardo's (1817) *Law of Comparative Advantage* operated at unprecedented levels, fostering the expansion of trading networks. Thus, the selective regime was changed, with more people participating in reproduction, flourishing of social supports, opportunities to accrue personal fortunes, more levers of power to grab, and less emphasis on martial valor and ingroup loyalty *vis-à-vis* other groups.

## 7 Compositional Changes Following from Demographic Growth

Malthusian theory is most accurate when discussed in the context of scarcity, rather than in the relative abundance found in many world regions within the last two centuries. Consequently, we can review a variety of factors making it appear that Malthusian predictions were falsified: warming trends following the Little Ice Age, the abundance of the New World absorbing excess migration, New World crops supplementing and sustaining Old World populations, advances in crop and animal selection, systematization, collectivization, and industrialization of agriculture, as well as the scientific revolution and related industrial revolution unlocking the power of machinery and fossil fuels. As profound as these changes were, especially in their collective and dynamic impact, none of them invalidated Malthusian logic, so much as raised the carrying capacity. Understanding this is valuable in and of itself, as it instills a proper understanding of history, demographics, and tamps down ebullient optimism about a future without constraints. More importantly for present purposes, we must connect the carrying capacity to the selective regime. Doing so connects gross growth with compositional changes. Resultant populations were not just larger, they were different. More precisely, changes in the carrying capacity did not simply create a larger population with the same attributes, metrics, and configuration across biopsychological variables, it instead promoted population growth with proportional changes in the composition of societies among these biopsychological variables. The complexities of the dynamic interplay between carrying capacity, technological innovations, and population growth are beyond the scope of this chapter. Generally speaking, and most true of Britain and eventually other Western European countries, we find selective pressures favoring group-selected traits due to heightened levels of resource competition between groups prior to the middle decades of the nineteenth century. Thereafter, we instead find selective pressures favoring individually selected traits. Severe group-selective pressures waned, allowing individually selected traits to become more prominent, beginning in the nineteenth century, and accelerating into the twentieth century. An attempt was made to analytically detect the effects of this shift in selective pressures.

An extension on a prior publication focusing on waning heritable general intelligence since the 1850s (Woodley & Figueredo, 2013), *The Rhythm of the West*, was organized around two diachronic analyses, each labeled for the span of historical time under review. There was the *Nexus 200*, reviewing AD 1810 to 2010, and the *Nexus 400*, reviewing AD 1600 to 1999. The word *nexus* as used above is an abbreviation of the *co-occurrence nexus*, which refers to an overarching, coherent higher-order factor comprising *heritable general intelligence* (gh), *specialized intelligences* (se), and *somatic modifications* (sm). In turn, these three lower-order factors rest upon, and are marked by, their relationship to fifteen convergent indicators. Again, indicators and lower-order variables alike cohere and covary within the aforementioned co-occurrence nexus.

As will be explained in further detail subsequently, the *Nexus 200*'s longitudinal analysis, controlling statistically for serial autocorrelations, found this suite of convergent factors causally linked to directional selective pressures, wherein extant ratios of group to individual selection were inverted. Whereas in prior centuries, group selection prevailed over individual selection, by the latter portion of the nineteenth century, one sees individual selection prevailing over group selection. The inversion of selective pressures itself was partially related to the aforementioned climatic warming and stabilization, both of which reduced the motive force of intergroup competition driving group selection. To these climatic changes were added the anthropogenic alteration of the selective pressures to which humans were historically exposed, courtesy of the harnessing of fossil fuels by industrialization. Taken together, we see a historical divide, on one side of which were organic economies with restricted reproductive capacities engaging in frequent war, and on the other side mineral economies with increased energetic and economic inputs being converted into demographic surges, now less restrained by the culling and limiting factors of war and cold.

The *Nexus 400* extended the period of analysis by approximately 200 years, reproducing and expanding those findings yielded by the Nexus *200*. The Nexus *400* analysis was partially based on a latent common factor representing group-selective pressure via between-group competition, combining two biodemographic indicators (national war mortality and national proportion of world population) with a single lexicographic indicator (frequency of altruistic word usage). War mortality was thought to be a gross marker of martial virtue and thereby linked to group selection. Population levels, relative to competing societies, mark demographic expansion, which is an indirect indicator of group selection (Okasha, 2006). Lastly, language communicates ideas and thus can be a marker for realities that are not simply semantic. This is the essence of the lexicographic endeavor within psychology, which has successfully been applied to other substantive problems such as those of personality measurement. Here *altruistically valenced* words were assumed to be associated with altruistic impulses expressed among members of a society. These three indicators then produced the between-group competition factor, indexing the generative pressures of group selection, the rationale for which rested on the correlations among these three indicators. As stated, these three indicators were aggregated into a latent common group selection factor, which was then found to negatively correlate with mean global temperatures, such that lower temperatures were associated with higher degrees of intergroup competition for resources. The group selection factor was also associated with higher levels of heritable intelligence at the population level. Some of the methodology and underlying analytics behind these findings will be elucidated subsequently; suffice it to say in this section that, from a general decline in group-selective pressures in that 400-year period, results suggested an inversion among the different forms of intelligence, with general intelligence declining in favor of more specialized forms of intelligence. However, unlike *The Rhythm of the West*, which focuses on intelligence as an outcome of shifting selective regimes, we are herein concerned principally with the selective regime itself. In other words, we here focus on waning group selection, rather than intelligence as a product of that process.

## 8 Biohistorical Analyses

We performed two separate biohistorical statistical analyses: (1) the *Nexus 200*, testing the co-occurrence model across the 200 years spanning AD 1810–2010, and (2) the *Nexus 400*, testing our climate-driven multilevel selection model of the evolution of intelligence across the 400 years spanning AD 1600–1999. The second period of time spans approximately 200 years of the Early Modern Period, comprising the end of the Little Ice Age, and 200 years of the Late Modern Period, comprising the period of global warming that followed and continues to this day. As in the biohistorical analyses presented in Chap. 11, data were collected for the following Britannic nations: the United Kingdom, the United States, Canada, New Zealand, and Australia.

For the *Nexus 200* analyses, fifteen hypothesized indicators of the co-occurrence nexus were collected, as detailed in Woodley of Menie, Figueredo, Sarraf, Hertler, Fernandes, and Peñaherrera-Aguirre (2017): (1) male fluctuating asymmetry; (2) sinistrality rate; (3) body mass index; (4) average height; (5) brain weight; (6) GDP per capita (micro-innovation rate); (7) concretization in language; (8) forward digit span; (9) psycholinguistic word use; (10) WORDSUM easy word use; (11)

*Descent of Man* altruism words use; (12) male reaction time; (13) backward digit span; (14) WORDSUM hard word use; and (15) macro-innovation rate per capita. These fifteen indicators of the co-occurrence nexus were aggregated into three lower-order factors: (1) somatic modifications; (2) specialized abilities; and (3) general intelligence. By reverse-scoring the somatic modifications and specialized abilities factors, we further aggregated these three lower-order factors into a single higher-order factor (*the co-occurrence nexus*). Figure 12.1, adapted from Woodley of Menie, Figueredo, Sarraf, Hertler, Fernandes, and Peñaherrera-Aguirre (2017), displays these relationships in graphical form and also provides quantitative information for the convergent validity coefficients among the indicators at each level of the hierarchy.

As with the *asabiyyah* analyses presented previously in Chap. 6, three nested MLMs were estimated to test the need for increasing

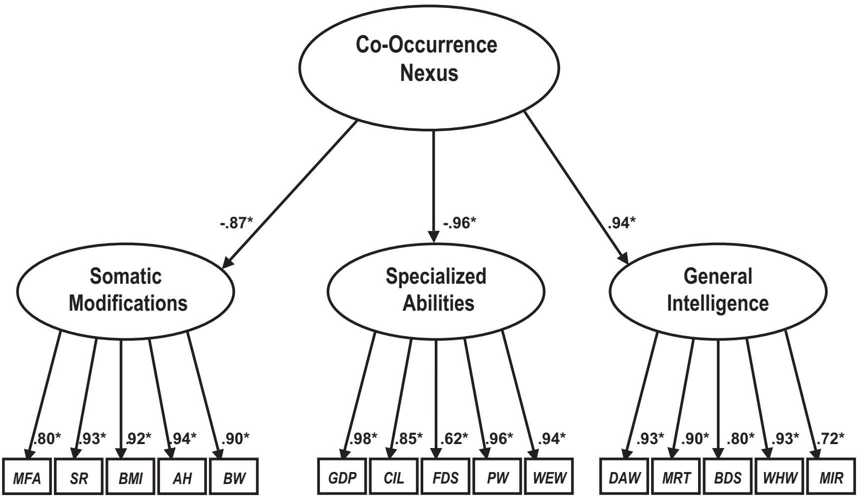



**Fig. 12.1** The latent hierarchical structure of the co-occurrence nexus from AD 1810 to 2010: (1) somatic modifications: *MFA* male fluctuating asymmetry, *SR* sinistrality rate, *BMI* body mass index, *AH* average height, *BW* brain weight; (2) specialized abilities: *GDP,* GDP per capita (micro-innovation rate), *CIL* concretization in language, *FDS* forward digit span, *PW* psycholinguistic word use, *WEW* WORDSUM easy word use; and (3) general intelligence: *DAW* descent of man altruism words use, *MRT* male reaction time, *BDS* backward digit span, *WHW* WORDSUM hard word use, *MIR* macro-innovation rate per capita. *$p<0.05$

parameterization as alternative hypotheses: (1) *MLM1* estimated a single intercept and a single logarithmic slope (the "unconditional" co-occurrence nexus) for all nexus factors and indicators over time, as well as the same intercepts and logarithmic slopes for all nexus indicators nested within each nexus factor; (2) *MLM2* estimated a separate intercept and a separate logarithmic slope for each nexus factor over time, but the same intercept and logarithmic slopes for all nexus indicators nested within each nexus factor; and (3) *MLM3* a separate intercept and a separate logarithmic slope for each nexus factor over time as well as a separate intercept and a separate logarithmic slope for each nexus indicator over time within each nexus factor.

Table 12.1 displays the pertinent nested model comparisons. The systematic AIC and -2RLL comparisons performed among the nested models representing the specific variance components of the nexus factors and nexus indicators indicated the following: (1) the specific variance components for nexus factors were statistically significant; and (2) the specific variance components for nexus indicators within nexus factors were also incrementally statistically significant ($p<0.05$). Comparisons of squared multiple correlations among the three nested MLMs yielded essentially the same results. The incremental magnitudes of the specific variances ($\Delta R^2$) were found to be non-negligible but relatively small for both the nexus factors (~2%) and the nexus indicators (~6%), in contrast with the common factor variance of the "unconditional" co-occurrence nexus, representing the higher-order construct, which was found to be quite

**Table 12.1** Fit indices for nested multilevel models of co-occurrence nexus, lower-order factors, and specific indicators as natural logarithmic functions of time with Britannic populations across the 200 years spanning AD 1810–2010

| *The co-occurrence nexus* | MLM1: Year | MLM2: + Factor + Factor*Year | MLM2: + Indicator + Indicator*Year |
|---|---|---|---|
| *AIC* | 2012.0 | 1957.9 | 1690.0 |
| *-2RLL* | 2008.0 | 1949.9 | 1682.0 |
| | $\Delta\chi^2$= | **58.1*** | **267.9*** |
| $R^2$ | 0.645* | 0.663* | 0.731* |
| | $\Delta R^2$= | **0.018*** | **0.059*** |
| | *ΔNDF*= | **4** | **24** |

*$p<0.05$

large (~65%). These results indicated that the unitary co-occurrence nexus did a reasonably good job of accounting for the temporal covariation among both factors and indicators over time.

Given the strength of these findings, we chose to report and interpret the model parameters for only the unconditional co-occurrence nexus (*MLM1*), as the extra model parameters added by the lower levels of aggregation (*MLM2* and *MLM3*) did not add very much explanatory power to our account of the diachronic variances in the co-occurrence nexus factors and indicators. The logarithmic intercepts (*a*) and slopes (*b*) of this unitary higher-order unconditional co-occurrence nexus construct over time were statistically significant: $a = 250^*$, $b = -33^*$ ($p<0.05$).

For the *Nexus 400* analysis, as with the biohistorical analyses presented previously in Chap. 6, MLM residuals were then exported for the between-group competition (BGC) factor, which was constructed identically as in Chap. 11 but estimated separately for the present sampling frame (see Fig. 12.2).

This MLM residualization is also done for a single indicator of the co-occurrence nexus, the lexicographic WORDSUM hard word use, which was the only nexus indicator that we could obtain for as far back as AD 1600. This served as an indicator of high verbal ability and indirectly of general intelligence. MLM residuals were thus statistically adjusted for the logarithmic effect of time as well as of any unstructured autoregressive serial dependencies among successive data prior to regression

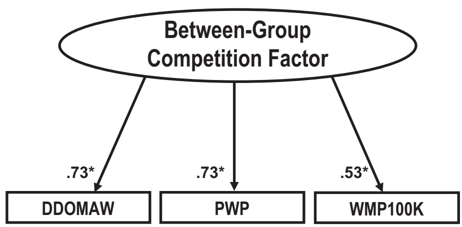
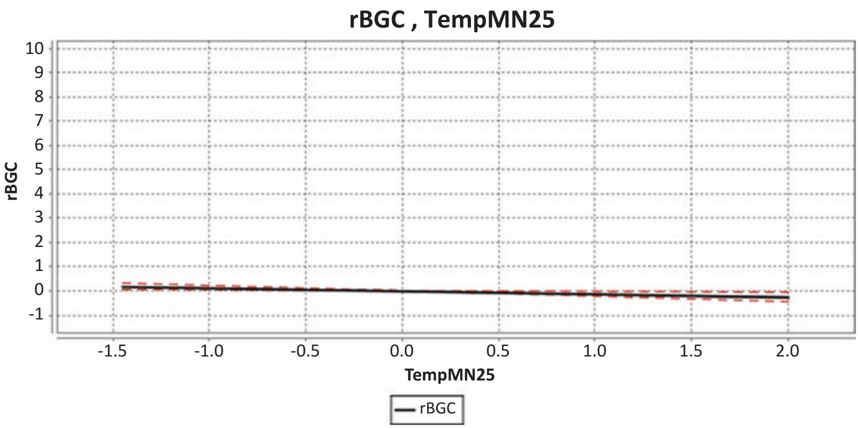



**Fig. 12.2** The latent structure of the between-group competition (*BGC*) factor from AD 1600 to 1999 (*DDOMW* Darwin's *Descent of Man* altruism words, *PWP* proportion of the world's population, and *WMP100K* war mortality per 100,000). Factor loading coefficients = Britannic, Gallic. **p*<0.05

modeling, thus circumventing this potential problem as a threat to the validity of correlational analysis.

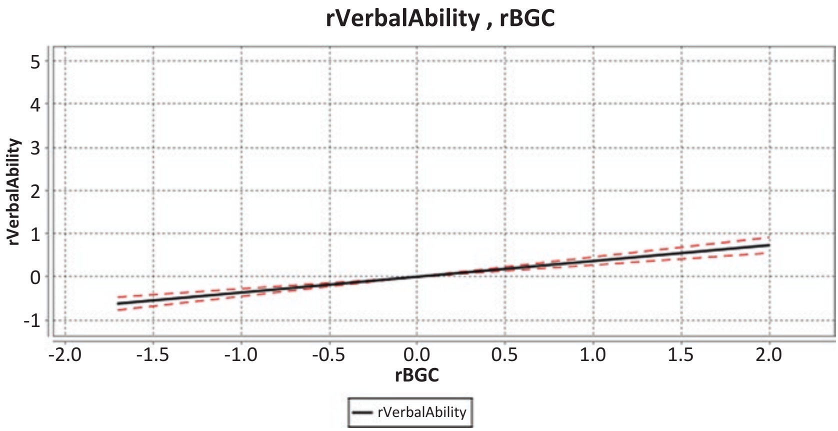
Both of these were modeled as a function of the twenty-five-year floating averages of mean global temperature (TempMN25), aggregated from three sources, as detailed in Woodley of Menie, Figueredo, Sarraf, Hertler, Fernandes, and Peñaherrera Aguirre (2017): (CRUTEM3) global annual land-surface air temperature anomalies (Brohan, Kennedy, Harris, Tett & Jones, 2006); (ERSST v3) global land and sea surface temperature anomalies from the GISS Surface Temperature Analysis project (Hansen, Ruedy, Sato & Reynolds, 1996; Smith, Reynolds, Peterson & Lawrimore, 2008); and (HadCET) surface temperature for Central England, measured in a roughly triangular area enclosed by Lancashire, London, and Bristol (Parker, Legg & Folland, 1992).

The semipartial correlation of the time-adjusted MLM residuals of BGC with TempMN25 was $r = -0.13$ (90% *CI*: −0.22, −0.03), $F(1,398) = 6.56$, $p<0.01$, empirically supporting the hypothesis that declining BGC is historically associated with rising mean annual temperatures, independently of the effects of time, as depicted in Fig. 12.3.




Note: Dashes are upper and lower confidence intervals.

**Fig. 12.3** Time-adjusted MLM residuals of between-group competition (*rBGC*) predicted by the twenty-five-year floating averages of mean global temperature (*TempMN25*) from AD 1600 to 1999. (Note: dashes are upper and lower confidence intervals)

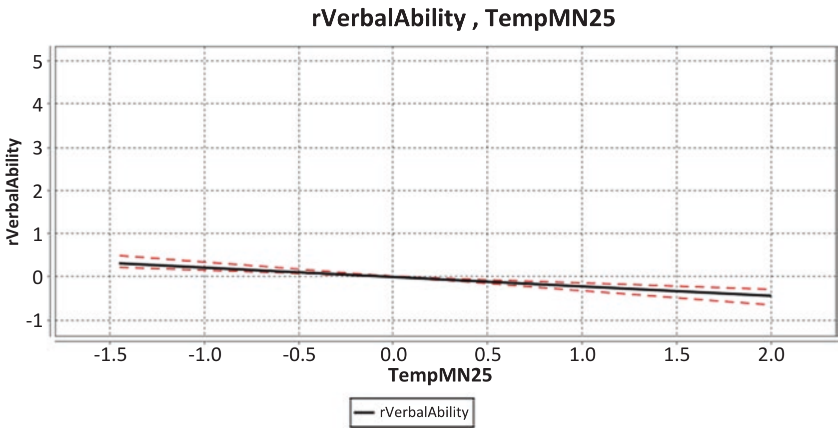



Note: Dashes are upper and lower confidence intervals.

**Fig. 12.4** Time-adjusted MLM residuals of verbal ability (*rVerbalAbility*) predicted by those of between-group competition (*rBGC*) from AD 1600 to 1999. (Note: dashes are upper and lower confidence intervals)

As seen in Fig. 12.4, now using the time-adjusted MLM residuals of BGC as a predictor, the semipartial correlation of the time-adjusted MLM residuals of the verbal ability indicator as a function of rBGC was likewise found to be statistically significant, but in this case positive, $r = 0.37$ (90% *CI*: 0.28, 0.45), $F(1,397) = 67.05$, $p<0.0001$, empirically supporting the hypothesis that higher levels of verbal ability (as a proxy for general intelligence) are historically associated with higher levels of BGC, independently of the effects of time.

Statistically controlling for the effect of rBGC on rVerbalAbility, we then estimated the semipartial correlation of the residual direct effect of TempMN25 on rVerbalAbility. This effect, as presented in Fig. 12.5, was found to be statistically significant and negative, $r = -0.24$ (90% *CI*: −0.33, −0.15), $F(1,397) = 28.61$, $p<0.0001$, empirically supporting the hypothesis that lower levels of verbal ability (as a proxy for general intelligence) are historically associated with higher levels of TempMN25, independently of the effects of time as well as of the selective pressure of between-group competition. Thus, global warming (TempMN25) has two negative effects on verbal ability: (1) one indirect and negative effect




Notes: Dashes are upper and lower confidence intervals. Prior partialled variable(s): rBGC

**Fig. 12.5** Time-adjusted MLM residuals of verbal ability (*rVerbalAbility*), statistically controlled for those of between-group competition (*rBGC*), predicted by the twenty-five-year floating averages of mean global temperature (*TempMN25*) from AD 1600 to 1999. (Notes: dashes are upper and lower confidence intervals. Prior partialled variable(s): *rBGC*)

through BGC, representing relaxation of group selection pressure; and (2) one direct and negative effect, representing relaxation of individual selection pressure.

From these results, we drew the theoretical conclusion that higher levels of general intelligence (as indicated by rVerbalAbility) were partially under group selection for the historical period in question. In our predictive models, about 14% of the variance in intelligence is accounted for by group selection (as indicated by rBGC), whereas only about 6% of the residual variance is accounted for by individual selection (as indicated by the residual direct effect of TempMN25), once statistically controlling the effects of temperature for any indirect effects through group selection (rBGC). This analysis is analogous to the one that we presented for chimpanzee intercommunity conflict, in that it breaks down the proportions of variance in different outcome variables attributable to group and individual selection, respectively. For example, we had found that individual selection accounts for 22% of the variance and group selection accounts for 11% of the variance in the relative fitness of individual chimpanzees using contextual analysis.

## 9 Conclusions

What this can all be taken to mean, biohistorically speaking, is that the colder global temperatures of the Little Ice Age (roughly contemporaneous with the Early Modern Era) increased the level of competition between groups and thus raised the magnitude of the coefficient of group selection. This had the indirect effect of selecting for a secular increase in general intelligence, as indicated by verbal ability. Afterwards, the warming temperatures of the Late Modern Era relaxed the group-selective pressure exerted by between-group competition, leading to a secular decrease in general intelligence and an increase in specialized intelligences that continues to this day. Direct climatic changes, as we have seen, were amplified by an approximate coincidence with New World trade surpluses, agricultural advances, and industrialization, the cumulative effect of which was to increase the carrying capacity, thus altering the proportions of group to individual selective pressure. These findings are consistent with those presented in Chap. 6, wherein a general reduction in *asabiyyah* was associated with rising GDPs. Moreover, this general reduction in competition between groups was illustrated in Chap. 11 through the waning rivalry between the Gallic and Britannic biocultural groups during the last two centuries.

Even as we are here most concerned with the changing selective regime itself, before closing, we turn again to intelligence, for it represents one of many potential consequences of waning group-selective pressures. In *A Farewell to Alms*, Clark (2007) makes the point that the most famous innovators of the Industrial Revolution contributed greatly to the welfare of their social group but “typically benefited little from their endeavors” (p. 235) as individuals. Clark (2007) lists how many of them instead died in poverty in spite of the riches they produced for others by their efforts. In the monograph *Historical Variability in Heritable General Intelligence*, Woodley and Figueredo (2013), after reviewing evidence from Clark and other sources in the literature, found the following two propositions empirically well-supported. First:

> the "genius fraction" of individuals disproportionately making intellectual contributions to society are either not benefiting personally or are actually sacrificing personal success, and thus putting themselves at a competitive disadvantage in within-group competition between individuals. (p. 69)

Second:

> that the societies in which these intellectual products are being generated benefit in comparison with other societies, and thus gain a significant competitive advantage in between-group competition. (p. 69)

What this adds up to is the theoretical prediction that higher levels of heritable general intelligence should be *disfavored* by the pressures of individual selection, but *favored* by the pressures of group selection. These predictions were followed up on in *The Rhythm of the West*, and it is evident that the results of the quantitative biohistorical analyses reviewed in the present chapter strongly support those conclusions, thus demonstrating the utility of multilevel selection theory in the study of human cognitive evolution.

## Notes

1. https://www.scientificamerican.com/article/why-malthus-is-still-wrong/
2. These are approximate dates. Fagan actually allows this period to extend to 1850, while other authors prescribe slightly different dates, even as there is broad overlap across sources.
3. https://en.wikipedia.org/wiki/List_of_famines
4. As explained in Life History Evolution: A Biological Meta-Theory for the Social Sciences, SPAs are an expansion of Alfred Crosby's *portmanteau assemblages* (1986), which are "co-adapted ecological associations between humans and domesticated flora and fauna, vermin, weeds, and pathogens, which act together as a unit in competition with rival assemblages upon contact." Our modified term simply recognizes the extent to which human

agency and humans themselves are not always central to the ways in which rival species assemblages interact, at least after being initially transported by humans.

5. Within the same territory.
6. Swann, N. (1998). Interview with Alvin Toffler, Australian Broadcasting Corporation Radio National, "Life Matters," 5 March.
7. Of course, the British Agricultural Revolution and Industrial Revolution overlapped in time and are in some senses therefore confounded. However, there was a fair amount of time wherein agricultural advances were present prior to appreciable industrialization, especially in the United States.
8. Within societies, industrialization has brought great wealth and was a rising tide that raised all boats. This is even true of non-industrialized societies, even as industrialization has increased income gaps between industrialized and non-industrialized countries.

## References

Allen, R. C. (2009). *The British industrial revolution in global perspective*. New York: Cambridge University Press.

Brohan, P., Kennedy, J. J., Harris, I., Tett, S. F. B., & Jones, P. D. (2006). Uncertainty estimates in regional and global observed temperature changes: a new data set from 1850. *Journal of Geophysical Research, 111*, D12106.

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

Clark, G. (2008). In defense of the Malthusian interpretation of history. *European Review of Economic History, 12*(2), 175–199.

Cressy, D. (2006). *England on edge: Crisis and revolution 1640–1642*. New York: Oxford University Press.

Crosby, A. W. (1972). *The Columbian exchange: Biological and cultural consequences of 1492*. Westport: Greenwood Publishing Group.

Crosby, A. W. (1986). *Ecological imperialism: The biological expansion of Europe, 900–1900*. New York: Cambridge University Press.

Fagan, B. (2000). *The little ice age*. New York: Basic Books.

Fischer, D. H. (1996). *The great wave: Price revolutions and the rhythms of history*. New York: Oxford University Press.

Frey, L., & Frey, M. (2019). *Townshend, Charles, second Viscount Townshend (1674–1738)*. Oxford Dictionary of National Biography (online ed.). Oxford University Press.

Gat, A. (2017). *The causes of war and the spread of peace*. New York: Oxford University Press.

Gause, G. F. (1932). Experimental studies on the struggle for existence: 1. Mixed population of two species of yeast. *Journal of Experimental Biology, 9*, 389–402.

Gause, G. F. (1934). *The struggle for existence*. Baltimore: Williams & Wilkins.

Grinnell, J. (1904). The origin and distribution of the Chestnut-Backed Chickadee. *The Auk, 21*(3), 364–382.

Grove, J. M. (2019). *The little ice age*. New York: Routledge.

Hansen, J., Ruedy, R., Sato, M., & Reynolds, R. (1996). Global surface air temperature in 1995: Return to pre-Pinatubo level. *Geophysical Research Letters, 23*, 1665–1668.

Irons, W. (1998). Adaptively relevant environments versus the environment of evolutionary adaptedness. *Evolutionary Anthropology, 6*(6), 194–204.

Landers, J. (2003). *The field and the forge: Population, production, and power in the pre-industrial West*. New York: Oxford University Press.

MacArthur, R., & Levins, R. (1967). The limiting similarity, convergence, and divergence of coexisting species. *The American Naturalist, 101*(921), 377–385.

Mann, M. E., Zhang, Z., Rutherford, S., Bradley, R. S., Hughes, M. K., Shindell, D., et al. (2009). Global signatures and dynamical origins of the little ice age and medieval climate anomaly. *Science, 326*(5957), 1256–1260.

Marx, K., & Engels, F. (1848). *Manifesto of the Communist Party*. Chicago: Charles H. Kerr & Company.

Okasha, S. (2006). *Evolution and the levels of selection*. Oxford: Oxford University Press.

Parker, D. E., Legg, T. P., & Folland, C. K. (1992). A new daily Central England temperature series, 1772–1991. *International Journal of Climatology, 12*, 317–342.

Ricardo, D. (1817). *On the principles of political economy and taxation* (1st ed.). London: John Murray.

Smith, T. M., Reynolds, R. W., Peterson, T. C., & Lawrimore, J. (2008). Improvements to NOAA's historical merged land-ocean surface temperature analysis (1880–2006). *Journal of Climate, 21*, 2283–2296.

Toffler, A. (1980). *The third wave: The classic study of tomorrow*. New York: Bantam Books.

Turchin, P. (2016). *Ages of discord: A structural-demographic analysis of American History*. Chaplin: Beresta Books.
White, S. (2013). The real little ice age. *Journal of Interdisciplinary History, 44*(3), 327–352.
Williams, E. E. (1972). The origin of faunas. Evolution of lizard congeners in a complex island fauna: A trial analysis. In T. Dobzhansky, M. K. Hecht, & W. C. Steere (Eds.), *Evolutionary biology* (pp. 47–89). New York: Springer.
Wood, R. J. (1973). Robert Bakewell, pioneer animal breeder and his influence on Charles Darwin. *Folia Mendeliana, 58*, 231–242.
Woodley, M. A., & Figueredo, A. J. (2013). *Historical variability in heritable general intelligence: Its evolutionary origins and socio-cultural consequences*. Buckingham: University of Buckingham Press.
Woodley of Menie, M.A, Figueredo, A. J., Sarraf, M. A., Hertler, S. C., Fernandes, H. B. F., & Aguirre, M. P. (2017). The rhythm of the West: A biohistory of the modern era, AD 1600 to present. *Journal of Social, Political and Economic Studies Monograph Series, 37*.