CLIMATE AND INTELLIGENCE

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Lynn is not the first to argue that the benefits of intelligence were greatest for those populations living in cold climates during the Ice Ages (for an early exposition see Huntington 1924, Chapter IV).[1] It is common to argue that the impetus for the enlargement of the brain size "during the era of *Homo erectus* was due to an expansion out of the tropics and into cool regions where ingenuity and flexibility of behavior were more necessary for survival" (Campbell 1976, p. 324). More recently, Calvin (1991) has argued that human intelligence was strongly selected for in cold areas during the Ice Ages, although without recognizing that this hypothesis had implications for the geographical distribution of intelligence. If conditions in the colder regions were such that there was strong selection for intelligence as to lead to the emergence of a new species (*Homo sapiens*), it is plausible that this selection for intelligence would also have led to a cline for intelligence in which intelligence increased as one moved toward the frigid regions.[2]

Physical anthropologists (Coon 1965, 1982, Krantz 1980) have examined the distribution of many traits and found that clines existed in which they varied with either climate (body size and shape, nose shape, hair type) or latitude (skin color). The characteristics for which clines in skin color and other external characteristics are argued to exist are the characteristics traditionally used to delimit one race from another. Thus the existence of a cline for intelligence such that intelligence increased with winter temperature would explain the racial variations in intelligence.

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[1] This slightly simplifies Huntington's theory since he felt the extreme cold of the Arctic regions or Siberia was not conducive to mental development and he attached high weight to the selection that occurred as populations migrated into the areas vacated by the retreating glaciers.

[2] Although in the current paper Lynn argues that Caucasians have roughly the same intelligence regardless of where they live, in an earlier (Lynn 1978), he reported that the Caucasoid people inhabiting the southerly latitudes from Spain through the Middle East to India scored lower than those with origin in Northwest Europe, evidence that clines in intelligence roughly parallel those in climate.

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These cold climate adapted races are the modern day Caucasians and Mongoloids, with the Mongoloids usually considered to be the more cold adapted. This is another way of reaching Lynn's conclusion that adaption to different climate requirements explains differences between races in intelligence.

There is a general principle here. A theory to explain human intelligence growth will normally imply that some populations were subject to greater selection than other populations. Thus the theory will have testable implications for the differences in intelligence between populations. One way to test theories of the emergence of intelligence (or other characteristics for that matter) is to see if their implications for the distribution of intelligence among existing populations corresponds with observation.

Lynn discusses the intellectual demands of large animal hunting and keeping warm in the cold as needs that led to intelligence being selected for. There are two more climate related variations in hunter-gather strategies that may have contributed to the growth in intelligence, the need to store food, and the abandonment of migratory way of life.

Binford (1980) has documented two empirical regularities in the behavior of hunter-gatherers which may be of evolutionary significance. One is that there is a systematic relationship between the extent to which societies store food and the effective temperatures where they live. Those in colder climates do more food storage, presumably due to the problem of "over-wintering," in colder climates. He reports that food storage is practiced only (with exceptions) in societies whose growing seasons are less than about 200 days.

Although Binford didn't deal with the intelligence required for the different strategies, the intellectual requirements of strategies do appear to differ. High intelligence has a greater benefit in climates where food storage is useful. First of all, intelligence increases the likelihood that the required storage techniques, such as drying, will be discovered. Secondly, successful use of storage involves looking ahead to the period of shortage, and postponing some consumption in order to store the food. Success with a food storage strategy requires ability to delay the gratification of eating available food. The ability to delay gratification appears to increase with intelligence. In experiments where children were forced to choose between a small candy bar now or a larger one later, the ability to delay the gratification increased with chronological age (and presumably with intelligence as measured by mental age) and also with IQ (Mischel and Metzer 1962). With intelligence contributing to the ability to delay gratification, the genes for intelligence would be more strongly selected

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for in climates where survival of cold winters necessitated food storage.

Once scarcity starts, it is necessary to ration the stored food. Mastery of the arithmetic needed is facilitated by intelligence. More complex social rules, such as eating only food stored by your family, may be required to facilitate storage. Higher intelligence appears to be needed in a society storing food than in one where hunter-gatherers find sufficient food for the day and eat it soon afterwards.

Another systematic difference found by Binford was between effective temperature and the extent to which hunter-gatherers were nomadic or settled. Fully nomadic cultures were most common near the equators and diminished into the temperate regions, only to increase again as the arctic was approached. He reports (p. 14) that "fully nomadic" strategies characterize 75% of the hunter gatherer cases located in a fully equatorial environment...; high mobility is also found in 64.2% of the cases in semi-tropical settings. In warm temperate settings we note a drastic reduction of hunter-gatherers who are 'fully nomadic' (only 9.3%), and in cool temperate settings the number is still further reduced (7.5%). Then as we move into boreal settings the number of fully nomadic groups increases slightly (11.1%), and in full arctic settings it increases drastically (reaching 41.6%)." None of the sedentary hunter-gatherers were reported from the tropical and semi-tropical regions.

Part of the relationship may derive from food storage. It is hard to sustain a nomadic lifestyle if one has extensive food stores to be moved.

High intelligence appears less useful in a nomadic band that frequently relocates. The burden of carrying artifacts from camp to camp prevents the development of any but minimal handicrafts. A highly specialized tool used for a single purpose may not be worth carrying (making the intelligence needed to invent and use such a tool of little value). Any shelters built must be of a simple form, since they will soon be abandoned.

In contrast, in a settled form of life, artifacts could be accumulated. The basis would be set for the discovery (if intelligence permitted) of the planting of specific food crops or the domestication of animals. With the ability to store artifacts, more elaborate handicraft industries can emerge. Intelligence is likely to be more of an asset in the production of such handicrafts than simple hunting and gathering.

Lynn, after drawing attention to Torrence's finding that people in northern latitudes make more tools and more complex tools than those in the tropical and subtropical latitude, suggests that this may reflect the benefits of carrying on more activities in northern latitudes. However, smaller tool assortments in the tropics may also be due to the inconsisten-

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cy of a large tool assortment with a migratory lifestyle (i.e. a cost rather than a benefit consideration).

Colder temperatures increase the advantages of a well built permanent home over a simple shelter, and are hence more likely to lead to permanent settlement. In colder climates permanent houses and fancier clothing are needed for protection form the cold. The construction of these require higher spatial intelligence. It is necessary to visualize how different building materials will fit together to provide a house, or to visualize how different pieces of material will fit together to make a garment. Tests of the ability to visualize how such pieces can be combined to make designated objects are frequently used in intelligence tests, creating a presumption that intelligence (and visual and spatial abilities in particular) would be an asset in the construction of such artifacts.

Lynn devotes much attention to the benefits in cold climates of having genes that lead to intelligence. He devotes no attention to the possible cost of these genes. Yet an important question is why everyone doesn't have the genes that lead to high intelligence since high intelligence would appear desirable to all.

For instance, after devoting much attention to demonstrating the correlation between head size and intelligence, and also noting the Beals, Smith, and Dodd (1984) finding that head size increased with latitude, he interpreted the correlation as being due to greater benefits of intelligence in northern areas. Another possibility exists. The brain, an organ which consumes a disproportionate amount of the body's energy (about 20%) also produces a disproportionate amount of its heat. In warm climates disposal of this heat could be a disadvantage of the genes that led to high intelligence. In cold climates, this extra heat would be an advantage. In effect, a secondary function of the brain is heat production. Energy is used to support a larger brain, rather than being wasted through shivering. A byproduct of the larger brain is higher intelligence, a fitness increasing characteristic. This implies that the optimal brain size would be larger in cold climates even if the benefits of intelligence were equal in all climates.[3]

Intelligence and basal metabolism are correlated (for documentation see Miller 1991). If this correlation arises because some genes both

[3] Although it is plausible that larger brains consume more energy and produce more heat than smaller brains, Hatazawa et al (1987) using positron emission techniques, found a very strong negative correlation between brain size and energy use per unit volume, sufficient to eliminate any positive correlation between brain energy and use and brain size.

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increase basal metabolism and raise intelligence, these genes would have been preferentially selected for in colder climates, creating a correlation between other characteristics that reflect adaptation to high latitudes (such as skin color) and intelligence.

Finally, it should be noted that because of the low (but clearly positive) correlation between brain size and intelligence, the differences between races in brain size can explain only a small portion of the observed differences in intelligence. Thus, the genes that determine intelligence appear to be many more than those that determine brain size. However, differences in the frequencies of the genes that determine brain size may be good indicators of the extent to which populations have been selected for intelligence.[4]

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[4] Or the differences in brain size may reflect selection for factors that have little to do with intelligence, such as ease of passing a birth canal in a pelvis whose design is determined by considerations of locomotion.

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WHY ARE RACIAL DIFFERENCES IN INTELLIGENCE NOT LARGER?

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The gene of the ability to taste phenylthiocarbamide (PTC), a psychophysiological trait, has (see Weiss, Lehrl, and Frank 1986, p. 142) a frequency of about 0.50 among Caucasoids, a frequency of about 0.38 among Japanese, of 0.13 among Navajo-Indians, and of 0.70 among Australian aborigines. The most impressive fact of Lynn's review on race and population differences in intelligence is their smallness. Differences between social strata within one population are larger than between races. We all know that an occupational group with higher education, whether black, white or yellow, has a mean IQ of about 125, the social stratum of unskilled workers a mean of about 90. In view of such social differences it will be always controversial, to draw from a lower mean of the Blacks in the United States the conclusion that Negroids are generally less intelligent. At best, such an inference should be based on representative samples of Caucasoids compared with pure Negroids from Africa where all social ranks are filled by one and the same race. Lynn's review showing a 30 IQ difference between Caucasoids and pure African Negroids is more persuasive evidence that this difference has a genetic basis than has hitherto been available.

Despite many thousand years of relatively independent evolution, Mongoloids in East Asia and Caucasoids in Europe (and in the New World) appear to have very similar gene frequencies of general intelligence. The similarity holds whether you are an adherent of a major gene locus (Frank, 1985) or of a polygenic basis of intelligence. However, if the polygenic hypothesis is correct then the IQ-correlation of about .50 between spouses would lead to a very rigid caste-like social stratification, far more effective than it ever has been in India. On the alternative theory, a major gene locus for intelligence with an allele frequency of about 0.20 (Weiss, Lehrl and Frank, 1986) for a gene Ml responsible in the homozygous state for an IQ of 130 is in accordance with the facts of social mobility within developed societies, where two generations are sufficient to climb or fall the social ladder from top to bottom, a fact which could have Mendelian segregation at such a locus as a background. In

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