Newsletter from CHICAGO?

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Last newsletter was in 1997! My move to Chicago seems a great time to get back on track. For anyone that might not know, I joined the faculty at Northwestern to start the new millennium.

The first piece in this newsletter is one that I recently had published in the MIT Faculty Newsletter. The second piece arises out of discussions with Prof. Jim Jackson of Boston University that followed upon his recent enlightenment regarding the existence of the mind. The book review of Jared Diamond's "Gun, Germs and Steel" summarizes discussions I have had with several of you.

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This newsletter (and all previous ones) can be found on-line at www.nwu.edu/bme/markj/. EMAIL responses to m-johnson2@nwu.edu are welcome and will be posted for review by the newsletter audience.

The Education of Our Leaders in the Next Century

The past half century has been a particular good period for the Massachusetts Institute of Technology. While MIT has long been known as perhaps the world's premier technical institute, MIT has considerably expanded in reputation becoming one of the leading international institutions of learning at both the undergraduate and graduate levels. MIT's reputation is perhaps even more exalted outside the United States as compared to that within this country, but everywhere, as the 21st century begins, it is viewed not only as a fine technical school but also as one of the most elite and prominent educational institutions on the planet.

Well, what has MIT been doing right? I propose that MIT has done nothing fundamentally different in 1999 than was being done in 1949. Instead, we might say that the Mountain appears to have come to Mohammed rather than Mohammed going to the Mountain. Technology has become the mantra of the last part of this century, and the educational process has necessarily put more emphasis on the technical subjects, math, physics, chemistry, biology and especially engineering. As MIT has always been very good at teaching technical subjects, it is not at all surprising that MIT has vaulted to near the top of the rankings, as top students have increasing chosen a more technical education.

MIT has not been alone in this success. If we consider the top 10 colleges ranked in the U.S New and World Report for 1998, we see other universities that specialize in engineering and

technology including Stanford, Cornell, Cal Tech and Northwestern. Northwestern is notable since the University of Chicago, long viewed as the "elite" university of Chicago, was ranked lower than Northwestern in 1998. The most highly ranked undergraduate schools in the United States are no longer the exclusive territory of the Ivy League schools. They increasingly have had to share these ranking with the more technical schools. While these ranking likely have little meaning regarding the true quality of education, they tell us much about people's perceptions of the changing educational environment.

As we move into a new century, I believe that these schools, that have their strengths in technology, have an opportunity to examine this changing environment and decide what their mission should be into the next century. While it will be tempting for these schools to continue with their strength given that technology seems to be taking an ever more dominant role in society, there will be new possibilities that will arise for those schools that have, somewhat fortuitously, risen to near the top of the heap.

The top schools in the United States, particularly the top 20 or so, have as part of their mission, to train our future leaders. Technology is without question an area that our leaders will increasing need to understand since they will by necessity be making an increasing number of decisions concerning technology and its application to society. However, a university that has developed excellence in technology is not necessarily one that will excel in training future leaders. Should a university decide that it would like to include training of the nation's leaders as part of its mission, it must include a well-rounded education as part of its curriculum, of the type traditionally associated with the Ivy League Schools.

Now I suspect that it would be argued by members of the administration of these "upstart" universities that they need not take the route followed by Ivy League Schools: look how many national and corporate leaders have already been developed by these technical schools. And yes, they have had considerable success. MIT alone can claim recently a Secretary of State, Director of the CIA, Secretary of the Air Force, many CEOs, not to mention founders of numerous startup companies. I, however, would again claim that these universities have been fortunate due to the rising importance of technology and that their weaknesses in providing a well-rounded education has so far been more than offset by their technical expertise, especially given the technical weakness of the traditional schools where future leaders once trained.

But new competition is developing. Ivy league schools are beginning to strengthen their technical programs and hope to reclaim what they have lost. Perhaps of even more significance is the development of a few universities with a strong technical reputation but with an equally impressive reputation for providing a well-rounded educational experience. Foremost among these is Stanford University that has demonstrated not only leadership in technical areas but is also ranked as a leader in a wide variety of academic pursuits. Stanford is not unique in this regard, as other universities such as the University of California at Berkeley have a similar reputation.

These universities have built well-balanced programs that leave them well-poised to be the leading universities of the next generation. Their success clearly involves a diverse faculty. I would propose that there are other important characteristics of their success. These include a well-balanced student body and a learning environment that foster well balanced growth.

Balance is the key, and balance comes from a

recognition that undergraduate education should not be focussed upon optimizing how much information the students are taught. Instead, it is about teaching the student how to learn and how to become a life-long student. It is also about opening vistas and view-points to allow flexibility in thought. While many technical schools seem focussed on long hours of work and home-work sets, a balanced education requires time for other areas of learning: organized extra-curricular activities, social interactions, athletics and significant time for talk between the students, among the most important of educational experiences.

Courses that emphasize problem sets have been a main-stay of the technical universities. Problem sets teach problem-solving techniques, and this is a crucial skill taught by these universities that is valued not only in the pursuit of science and technology, but more recently by investment bankers, financial analysts and other areas where technical skills have found new applications. However, my impression is that recently, professors at technical universities are using problem sets not only to teach how to solve problems but are increasingly using them to introduce the students to a wide variety of technical topics. This is not to say that home-work sets, tests and hours upon hours of study are not central aspects of the educational process, but when studying begin to squeeze-out all other activities (as it does at several of the top technical universities), the educational process is not enhanced.

Students need time to be introduced to other areas, and they need time for personal growth. They need time to read the classics, to expand their communication skills, to investigate the arts, to understand history and politics, and they need time to mature and to interact with their peers. They very much need time for extracurricular activities. For most students, the college years are the first time that they are out on their own and making most of their decisions by themselves. Their growth as an individual is just as important as their growth in knowledge.

It is notable that Stanford's unique educational environment includes athletic teams that are competitive in almost all sporting areas with the very top universities in the country. Thus, while a number of east coast universities maintain that athletics must be kept at a Division III level to prevent a diminution of the educational mission, Stanford has managed to consistently produce top athletes in a wide variety of sports (including the major sports) while also producing what is unquestionably academic excellence.

Athletics is a central part of a well-rounded education. There are the old saws about the importance of learning team work, learning about your own potential, experiencing new activities, and health benefits of sports. However, these objectives can largely be met with a physical education program. Intercollegic competition, especially at the highest levels, inspires a dedication and enthusiasm not seen in intramural sports or local interscholastic competition. This is not to degrade these pursuits, but leader are exceptional individuals that excel when given exceptional challenges. Furthermore, at the young ages that these individuals prepare to attend college, these athletic dreams are frequently foremost in their thinking. Those universities wishing to recruit these future leaders must necessarily provide the challenges these student athletes seek.

Academic excellence, athletic and other extracurricular opportunities, a diverse faculty and a balanced learning environment: these are the characteristics that talented students and potential future leaders look for when choosing a university. A university that excels in all of these characteristics is going to have a well-balanced student body.

It is the interaction between these students that is perhaps the most important aspect of the university educational experience. Their discussions with one another, both relating to academics and other aspects of their formative years, are foundation of the learning experience. For these discussions to achieve their maximum possible impact requires a well-balanced student body, of the type that will be drawn to a well-balanced university. The "nerd" label, still associated with some technical university, will continue to hamper their efforts to diversify the educational experience of their students.

While new opportunities for an expanded educational mission will likely arise for the top technical universities in the country, these universities will necessarily need to decide whether such an expanded educational mission might interfere with what has up to now been their fundamental mission, namely that of providing the finest technical education possible. Most of the universities will likely decide that continuing to provide the finest technical education need remain their fundamental focus. However, a few of these universities might find that their unique capabilities will allow them to somewhat alter their mission and aid in producing a new generation of leaders better able to address the many technical challenges that they will face.

More thoughts on Free Will and Determinism

I have previously argued that free will is inconsistent with determinism (not a novel finding), and further found (see Newsletter 6: On Free Will and God) that free will is supernatural and in a very real sense a demonstration that miracles (supernatural events) are possible and occur as everyday events. Jim Jackson, with his new and expanded worldview (a likely consequence of Newsletter #6 and coursework at BU), might reluctantly concede that there could be more to the world that simply a deterministic set of events, with the *mind* somehow taking an active role. However, he has asked previously, and still poses the question as to how the determinism required of a scientist might be reconciled with a faith in supernatural events (a necessary consequence of belief in free will). Can a scientist believe in free will? Must a scientist have one set of beliefs in the laboratory and a second set when considering his or her personal situation in the universe?

While not offering a unique solution to this question, I will suggest here that one can imagine a structure to the universe that allows both for free will, and yet allows "determinism" at the scientific level. I will borrow the concept of multiple universes from science fiction and from quantum mechanics. By multiple universes, I don't mean those involving Mr. Spocks' trekking from one universe into a parallel universe and running into an evil Captain Kirk.

Instead, I envision an extremely rich set of universes that are much closer to one another such that *all possible universes exist simultaneously at each moment in time*. However, our individual timeline (our "consciousness") exists in only one of these universes at any moment in time. I imagine that each universe have events proceed in a deterministic fashion, void of free will. Quantum mechanics and chaos allow that universes that are nearly identical at one point in time might still evolve to be quite different as time proceeds, but each in a deterministic fashion.

Now, how does this allow for free will? Well, the notion would be that our consciousness or "spirit" could jump between nearby universes at any point in time at which a decision is made. Thus our consciousness would taken a highly ramified path though this spaces of universes, even

though each of universes in and of themselves are purely deterministic.

Note, however, that while each "universe" would be deterministic, the "meta-universe" comprising this infinity of universes and the combined spirits of all sentient beings (or "spirits") would not be deterministic. The pathlines of the spirits would depend on free will and not be deterministic.

Now, how do we (our consciousness or spirit) "jump" between universes? How often can we jump? And how far can we jump? Well, if these jumps were a consequence of quantum mechanics, then jumps would be continuously possible, although only between nearly identical conditions between two "adjacent" universes. Thus, we would not have access to all universes at any time, just those that are sufficiently close (or similar) to the universe we are in at any moment such that the jump or "choice" is possible, allowing for our free will.

I realize that this is a somewhat of a bazaar notion, but it seems no more inconceivable to me that does the already very strange world of quantum mechanics. I'm not sure that I believe that we exist in such a "meta-universe", at least not one as simple as that described here, but I think this construction does demonstrate that we can imagine a deterministic universe that nonetheless allows for our own free will. However, that free will must, in some sense, exist in a meta-universe that is not deterministic. Thus, for the scientist struggling with issues from free will, some flexibility in his or her thought might be required to match the flexibility and mobility of his or her spirit!

BOOK REVIEW: *Gun, Germs and Steel* by Jared Diamond

Prof. Tom Bania, of Boston University, kindly gave me Jared Diamond's book as a gift upon my departure from Boston. I have subsequently found that a number of you have read this book, and have discussed this text with several of you. I wanted to pass on some of my reflection on this winner of the Pulitzer Prize.

Jared Diamond asks the question of why the Eurasians conquered, displaced or wiped out many of the Native Americans, Native Australians and the Africans, as opposed to the reverse occurring. He asks whether this was the result of natural genetic differences, or if it might be explained by geographic origins of these peoples, with there being certain natural advantages occurring to peoples that developed in certain regions of the world.

Diamond postulated that certain plants and animals, indigenous to the Fertile Crescent (where civilization is thought to have originated), were uniquely useful in the development of civilization. In particular, what was required was cultivatable plants and domesticatable animals, and the presence of several of these in the Fertile Crescent may well be part of the reason why civilization first developed there.

However, other geographical locations around the globe also were home to plants and animals that could be cultivated or domesticated. Diamond ask why the rate of development of civilization was faster in Asia and Europe than in Africa and in the Americas?

This leads to Diamond's central thesis, namely, that the spreading of the techniques for cultivation of plants and domestication of animals from one culture to another would only succeed if the regions to which this technology was to be transferred could also support these particular plants and animals. Diamond cleverly argues that such a transfer would largely be precluded in the North-South direction since the environment changes dramatically in that direction. Plants and animals

that survive at one latitude would not survive at another. This greatly slowed technology transfer in the Americas and in Africa since these continents have their axes in the North-South direction.

However, in Europe and Asia, the continental axis is primarily in the East-West direction, and thus, techniques for cultivation and domestication developed in one area could easily be transferred to another. This, he argues, greatly facilitated the rate of technology development since whatever was developed in one region could easily be spread to another.

The remainder of Diamond's book flushes out the details showing how this process inexorably lead to technological developments that included guns, steel and germs, each of which was of overwhelming importance in the conquest, displacement and destruction of a number of cultures by the Eurasians.

Before reading Diamond's book, I would have agreed with most of the hypotheses that he put forth. However, by time I had finished the book, he had talked me out of, at least, part of his fundamental hypothesis. My objections to his arguments given will be detailed below, but my main criticism is more of form that of substance, although it contains an element of the latter. Jared Diamond is a well-known physiologist who has contributed to scientific advances in several areas, including those I am involved with. He helped to develop a theory known as standing-gradient model that explains the mechanism by which epithelial cells can secret fluid. It is a very clever theory, although lately it has been under some attack. I still find it the best explanation of how fluid is transported by an epithelium. His methods and arguments leading to this theory are those of a good scientist.

I found no such systematic approach nor such well thought-out propositions in this book. It seems more the work of a scientific popularist that proclaims a somewhat sensational proposition and then goes on to support it by citing a few bits of supporting evidence and ignoring any facts that might not fit neatly into the theory. Then, as most of these pseudo-social-scientists are prone to do, he goes on the stretch his already overextended theory to explain propositions that even under the best of circumstances the theory could never be expected to apply to (e.g. such as his explanation of current divisions of power between Europe and China that have arisen in the past 500 years). This type of megalomania is common in the lay scientific press, but, thankfully, usually absent from serious scientific work. I was very disappointed to see a scientist of some renown use his title and reputation to enter the pseudo-social scientific arena.

The fundamental thesis of the book, that middle latitudes on the European/Asian continent conferred an evolutionary advantage to those human societies arising in those regions with regards to developing culture, methods of warfare, and untoward development of disease, may well be true. However, the only opposing theory that Jared presents, his straw man, is that differences that have arisen between cultures and technologies of different peoples are based in genetics, rather than in the environment. Are those the *only two theories that he could manage*?? It is rather easy to demolish the latter theory, but that provides *no proof* of the former. How about several alternate hypotheses?

How about this: agriculture was founded in the Fertile Crescent some 10,000 years ago, *by accident*. Then, agriculture slowly spread with those cultures that were closest to the Fertile Crescent (considering both distance and difficulty of getting there, e.g. deserts, mountains) being those

that agriculture passed to next. Those closest to the Fertile Crescent developed faster than those further away because those that were closer developed agriculture first. Nearly every finding in this book could be explained by this simple theory.

How about another theory: that randomness plays a significant role both in the technological development of culture and also in the results that occur when cultures clash. Randomness could be due to effects of individuals or simply the coincidence of events. It is certainly plausible that a few individuals might have a significant effect on history. Thus, very different outcomes might have occurred if a few key individuals were born in different places, or alternatively, if events occurred with a slightly differently chronology.

While this second theory would be very hard to prove, note that the conquest of the Americas by the Europeans was not nearly the certainty of advanced technology that is posited by Diamond. The Americas were visited by the Vikings many times between 1000 and 1400 AD, with the Vikings the losers in all cases. Why the difference? Clearly, no guns and no steel (and germs didn't seem to make much of a difference at all)! If the Spanish had arrived in Central America several hundred years earlier, they might well have been wiped out. It was the rapidly rise of technology during the Renaissance that made a key difference. Had this been delayed, an easily imaginable possibility given the duration of the Dark Ages, quite a different result might have resulted.

I put forth these two alternate theory not as proof, but simply to show that Diamond considered no reasonable alternatives to his theory. And furthermore, he seems to have sought no compelling tests of his theory, although several tests naturally suggest themselves. I have already mentioned the Viking attempts to colonize the Americas (Newfoundland). These were failures, and even their colony on Greenland, which survived for hundreds of years, ultimately failed while the Inuit (a New World tribe) continue to live there to this day. This seems an obvious shortcoming of the theory.

The second half of this book does have a number of examples where Diamond describes one island conquering another one, or something similar, and thus the suggestion that there might be a number of tests of his theory. However, in all of these cases, he does little to indicate how the indigenous plants and animals of a region or latitude explain why one culture succeeded with respect to another. (*WHY* did the Bentu overtake the Khosians? *WHY* did the New Guineas have a method of food production that allowed them to survive the Austronesian expansion but not the Indonesians, whom one would expect to have developed on islands that had similar indigenous plants and animals to New Guinea?)

I also had some problems with the detailed facts that Diamond provided. Many statements appeared to be put forth as fact with little supporting evidence. While most of the book involves details of cultures, agriculture and history that I know little about, I read more closely his sections on the plants and animals of the Eastern United States. This is key to this argument about why the Americas did not develop the level of culture (guns, steel and germs) found in Europe.

Here, I suspect, Diamond may be wrong on a number of issues. His list of native cultivated plants: squash, sumpweed, goosefoot, and sunflowers, struck me as strange, since, as many of your know, I hunt for wild plants in the Eastern United States. Of these plants that he lists, I have only found sunflowers in the wild. If all of these plants were native and then cultivated, I would expect them to be plentiful in the wild. Squash in the Eastern US? Not that I have seen nor is it de-

scribed in any wild plant book that I am aware of. And I have no clue what sumpweed is, nor is it in any of my wild plant books (he claims that it is related to ragweed). Goosefoot I suspect is simply the wrong name. It should be lambs' quarter, and a trip to the Field's museum in Chicago supported my conjecture that this was a staple food for the Indians of the Eastern US.

But what of other foods. He claims that there are no other indigenous wild plants useful for cultivation in the Eastern US. But there are several. Cattails are ubiquitous and are very nutritious. Again, the Fields' museum indicates that this was a staple food for the Eastern Indians. Yet not a mention from Diamond. What about grapes?? The Eastern US was known as Vineland to the Vikings. Yet Diamond says there were no plentiful fruits. Grapes, of course, when dried become raisins so this could well have been a nutritious food source that could have been stored.

Now let us turn to domesticatable animals. *No domesticatable animals??* Well, I just couldn't wait until Diamond got to the buffalo (bisons). No evidence was provided as to why the bison could not be domesticated. Diamond simply dismisses bison with the following statement: "While bison meat occasionally appears in some US supermarkets, ..., none of these efforts has yielded sufficient economic value to attract ranchers." Well, I don't quite know what his point is (certainly this does not pass for scientific evidence), and I have driven by farms that have bisons in the pastures. That bison is not now as ubiquitous as cow does not explain why this domesticatable animal was not domesticated by the Indians. Goat is not as ubiquitous as cow, but goat was domesticated. I expect the answer might be that there was no need (prior to 1500) to domesticate the buffalo, because of the large size of the herds. And the question of WHY an animal ultimately is domesticated might have been a fruitful area for Diamond to explore, had he not dismissed such an obvious question out of hand.

Finally, even if we accept Diamonds' thesis that the Eastern US did not have cultivatable plants that could lead to an agrarian culture, clearly Central America did (corn, beans and squash). Certainly there was significant spreading of these crops on a North-South axis, from one culture to another. Why then did not Central America develop an advanced culture that would have survived the contact with the Europeans? Diamond barely touches on this crucial question, yet it puts his entire hypothesis in question.

My conclusion is that this is a pseudo-scientific analysis cloaked as being something more than that. It seems to me that all of the examples given by Jared Diamond to support his theory would also support this second theory I suggested. His theory may be the better one, but he took no time to develop alternatives. He simply took genetics differences as his whipping boy and, given the political correctness of that point of view, provided that as the only alternate theory. I doubt that one scientist in five would have taken agreed with the genetic viewpoint, and thus this book can be viewed more as a social statement, perhaps in reply to "The Bell Curve," but with not even the scientific level achieved in that flawed work.

I presume that the distinguished Professor of Anthropology and Applied Archaeology at the Eastern New Mexico University will be preparing at detailed analysis of this diatribe, and I look forward to Prof. Durand's comments!

Recipes

I have no new recipes (wild or otherwise) to offer this time for this newsletter. I will await suggestions such as I anticipate Debbie Diggs of Pittsburgh might have!