
Newsletter from Boston

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Political Notes

There are a few topics left over from the last newsletter that I wanted to briefly comment on. First, during my political adventure of last year, I gained an increased respect for our political process. I used to think that our long, drawn-out process of electing a president (a process taking well over a year) could be greatly shortened. I now see that this long campaign process is an extremely important exercise in organizational management for the candidates. What this process does is to require a candidate running for political office to put together a campaign organization, raise funds and wisely allocate these funds, and deal with crisis management on a number of fronts; these tasks are very similar to those awaiting a newly elected president. Thus the process of running for president is not only a presenting of that candidate's views to the voting public, but also a test of his or her capabilities of picking quality personnel and running his/her campaign organization.

Much of Bill Clinton's success can be traced to the excellent campaign organization that he put together during the primary season and his own personal efforts in managing this organization. I think we now see in these early days of Bill Clinton's presidency that he is drawing heavily on the skills that he demonstrated during the electoral process.

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One aspect of the political process that I think could use some improvement is the ordering of the state primaries and caucuses. I fully support the launching of the electoral process in a state with a small population (e.g. New Hampshire), so that relatively unknown candidates can have a chance to get their views out to the people without having to rely entirely on the media; otherwise, only candidates with that are able to quickly raise a great deal of funds would have a chance. *However*, it does not seem reasonable that the small New England state of New Hampshire should have such a dominant influence on our national politics every four years (recall that in 1988, it was Bob Dole's loss in New Hampshire, largely crafted by New Hampshire Gov. John

Sununu, that put George Bush on his way to the Presidency). I would suggest that the first primary rotate between four or five regions of the country, perhaps New Mexico, Idaho, Iowa, New Hampshire and Tennessee.

Finally, one last political note, I have argued in the past that one does not need to use negative campaigning to win an election. While I had originally planned to deal with this topic in this newsletter, I think that Bill Clinton has already demonstrated this point in the election last year. He showed that if one responds quickly to negative campaigning with statements of fact and if one quickly points to the tactics being employed by the opponent, then one can maintain the high ground and build respect with the electorate. George Bush lost significant support during the last election due to his negative campaigning, and was ultimately forced to drop this tactic due to Bill Clinton's positive strategy.

Intrinsic Differences in Intelligence Between People

This is a topic that I have discussed with many of you over the years. I must admit, before starting, that few people agree with the hypothesis I put forward here, namely, that there is no intrinsic (genetically based) difference in intelligence between people, nor is there a very early imprinting period for infants which sets their educational potential. While few of you may agree with me here, I think it important that we think carefully about this issue, since our country appears to be moving

to update our education system to compete in the new international economic environment, and the issue of educational potential of different individuals may have a direct bearing on the individual rights of these same people.

First, let me be careful to define terms since I'm sure that the way I have phrased the hypothesis, namely that all people have equal intelligence, must seem patently false. Intelligence is really a group of attributes that describes the *mind* of an individual, and these attributes include speed, memory, creativity, and logical capacity. It is only the latter faculty, that of logical capacity, that I claim is the same for all people. By logical capacity, I mean the capability to understand a particular concept. In other words, I am claiming here that all individuals have the capacity to understand any particular logical thought or concept.

My "proof" of this proposition is relatively simple. I claim that when ever we learn anything new, we do no more that recombine old concepts in a new way. When we identify a new idea *D*, in reality we have begun with old idea *A* and old idea *B* and combined them using some old concept *C* for combining ideas; *A*, *B* and *C* are each notions that we have already understood; *D* is the new idea that results from the recombination of these notions. Thus, in terms of our understanding of the relationship between facts (as opposed to our knowledge of facts themselves, which relates more to experience and memory), we don't ever really learn anything "new", but instead we learn to recombine our knowledge

in new and novel fashions. For instance, when we “learn” multiplication, we are shown that it is just a particular form of addition, and when we “learn” the concept of a derivative in calculus, we are led to this by considering the slope of a line and then applying this idea to a curve.

As I am sure that I will be criticized for using two mathematical examples, let me choose another example, recognizing that most knowledge is far more complicated than mathematical knowledge and thus more difficult to pose in terms of these simple examples. Nonetheless, consider an exercise in analyzing a novel such as the *Magus*, a favorite of mine: in this novel, John Fowles sets forth the concept of love which is a free choice between two individuals, and of God, all powerful and all knowing but seemingly contradictory to a free choice by these individuals. Fowles makes the novel introduction of the direct interaction between God and the individuals in love, and looks to explore this interaction, hoping to resolve the seeming logical contradiction between free will and God’s plan. This leads to a wonderful concept Fowles calls the *God’s Game* that I leave those of you that have not read this book to explore. This, in a very different discipline, is again a form of recombining knowledge to rise to a higher plane.

Now, returning to the proof I gave for the proposition above ($A, B, C \rightarrow D$), I remind those of you that may recall the Socratic dialog “The Meno” that the proof I gave above is not novel. In “The Meno”, Socrates argues

that “for seeking and learning are in fact nothing but recollection.” Socrates goes on, using only questions, to show that even a young slave boy, who knows nothing of geometric theorems, can “recall” the Pythagorean theorem. Socrates’ argument is in essence the same as I made in the paragraph above.

Now, how does this demonstrate that all people have equal logical potential? Well, let us postulate that a particular individual cannot understand a particular concept, Z . Then there must have been a previous concept W or X or a method of combining these concepts Y that this person also did not understand. But, of course, if this is the case, then there must have been another earlier concept that was also not understood. This leads us back through earlier knowledge (like $V, U, T \dots$) until we end at some primitive concept (say A) that was originally not understood.

Thus, if there are concepts that some people can understand and others can not, then there must be very primitive concepts that some people cannot understand. But I claim here that the set of primitive concepts that people are born with must be the same.

What are these primitive concepts? I have written elsewhere that these concepts involve the notions of equality, cause and effect, mutually exclusive phenomena and logical consistency. However, the particular forms of these primitive concepts are not relevant. The set of primitive concepts that we use to ultimately build our knowledge base upon must

be a set of universal concepts (in Chomsky's sense of a universal grammar); otherwise, we would not be able to communicate with one another, since we would not have a common basis. Furthermore, someone that did not have one of these primitive concepts would immediately be identified as learning disabled since at the earliest stages of life, there would quickly be many concepts that could not be understood. No evidence of this is apparently for young children.

Now that is not to say that there are not intrinsic differences between people in their ability to come up with new ideas and new combinations of thought. It requires creativity to see that old concepts can be recombined in a new way to yield a new insight. It seems clear that some people are more creative than others. I only claim that once a new insight has been found, that it can be taught to all other people.

I think that this discussion here is particularly relevant today as our country decides how our educational system compares with the educational system in other countries. The German and Japanese systems have, among other differences between their educational system and ours, the fundamental difference that they strive to identify capable individuals at a very young age (roughly 12 to 14) and decide at that point who will be the professionals and who will be the trade workers. In our country, however, we do not force this decision to be made until much later. As the arguments presented above indicates, I'm not sure that the intrinsic differences between people

justifies this approach nor do I feel that even if differences in some aspects of intelligence exists, that our educators can properly differentiate between individuals of greater and lesser ability at such a young age.

More likely, is we were to adopt an educational system like the German and Japanese models, especially in a highly diverse country like ours with a wide variety of educational backgrounds, discrimination would result. Given that the arguments I have given above suggest that most or all of us are equally "educatable" (albeit at different rates), early decisions of who deserves higher education and who does not, does not seem warranted in our society.

On Aging

Some of you have asked about the research work I am doing. The three principal areas I am working in right now are glaucoma, aging and chaos (a hot topic in mathematical research these days). My work in glaucoma has actually yielded an exciting hypothesis that may finally explain the cause of this disease (unexplained for over 100 years), but this information must remain confidential at the moment. However, part of this hypothesis relates to work I am doing on aging at the moment, and perhaps some of you may be interested in modern notions of what causes the aging process and the rather novel hypothesis this has led me to.

There are numerous theories as to why our

body ages, but it is key to note that the aging process cannot be localized to one part of the body, to a particular organ system or to one cellular component: the entire body ages at roughly the same rate (actually the brain may be an exception and actually age slower than the rest of the body). The problem with most aging theories is that they lead to predictions that a particular part of the body should be the first affected by the aging phenomenon. Included in theories having this problem are progressive immune system failure, cross-linking of proteins throughout the body, damage due to free-radical (highly reactive species usually formed by oxygen or sun light), or a limitation on the cellular or genetic replication number.

A theory that adequately explains aging must have as its foremost requirement that it explains the uniformity of aging throughout the body. A theory that I have increasingly been drawn to is called the theory of "Late-Acting Deleterious Genes" (first proposed by Haldane, 1941 and Medawar, 1952). This novel theory proposes that senescence might be due to the accumulation over time of the random effects of *deleterious genes whose purpose was served earlier in life*. All actively translated genes have a time-scale during life in which they act: some act in embryo, some during development, some during child-rearing times, a special set apparently act during menopause (the human is unique among mammals in having the phenomenon of menopause), and finally those that act during old age.

Now is it highly unlikely that any genes are particularly adapted to act preferentially for old individuals. This, of course, follows because older individuals may die due to one or another random causes, and thereby eliminate the utility of such a late acting gene; only genes that act early in life in a fashion promoting survival will be successful in the fashion first described by Darwin (survival of the fittest). While this seems obvious, one consequence of this may not be, namely, that *the beneficial early acting genes may have deleterious late consequences*.

Because some of these genes are optimized to promote survival at an early age, they are highly *unlikely* to be optimized at a later age. In fact, their effects at a later age are likely to be random: some times neutral (like the turning gray of hair) while others more deleterious. This phenomenon is not localized to any one organ system but will be occurring throughout the body. Thus this theory blames the aging process on the untoward consequences of genes after their purpose has been served.

I have recently found that this theory may well be related to my own work. A particular compound of interest in the study of glaucoma is hyaluronic acid, a long chain, highly negatively charged polymer that is ubiquitous in the extracellular space throughout your body. This compound is highly hydrated and used to maintain the high water content of our bodies. I have postulated for quite some time that both aging and glaucoma are related to a loss of this compound, but I could not explain this

relationship.

Now, with use of the theory of late-acting deleterious genes, I can better motivate my postulate: the theory of deleterious genes presupposes that the earlier a gene acts during life, the more likely it is to cause deleterious effects later in life (some of you may note that this leads to a straight-forward relationship between cancer and the cellular growth inhibition that occurs early in life). Hyaluronic acid, as it turns out, is extremely important in the development of the embryo: because of its highly negative charge, this molecules expands rapidly in solution, and is used during development to form many of our tissues.

Since this compound is optimized to form tissues early in life, the theory of late-acting deleterious genes would predict that, later in life, there may be deleterious consequences of the genes that produce this compound. In fact, there is a pronounced loss of hyaluronic acid and similar compounds in the later years of life, and this leads, among other consequences, to the body becoming less hydrated with age (this is the fundamental reason why older people are smaller and have wrinkled skin).

My hypothesis extends from here to presume that this loss of water causes the body to become more *hydrophobic* with age (since loss of hyaluronic acid and similar compounds decreases the potential for tissues to hold water), and this causes many undesirable consequences. These may include arteriosclerosis (lipids may begin to accumulate in re-

gions of the arterial walls which become more hydrophobic), glaucoma (the outflow pathway in the eye may become clogged up with “junk” because it has become hydrophobic and thus “sticky”), and a generalized loss of functionality due to lipid accumulation throughout the body.

We have recently developed a novel method to measure the “hydrophobicity” in different parts of the body with the aim of determining whether the body is indeed becoming more “hydrophobic” with age; we hope to have the results within the year.

I expect to receive a few comments on the second topic above as this one is prone to generate “discussion”. If so, I will try to include these responses next time.

Mark
