

EDISON AND ST. CYRIL: SEEKING COMMON GROUND*

Presentation at Honorary Degree Award Ceremony

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Rector Biolchev, Dean Mitev, and distinguished guests:

I have been trying hard in recent months to avoid listening to pompous pronouncements about a new millennium. My instincts as a scientist and as a mathematician tell me that this view of the passage of time is relative. After all, this is year 1420 in the Islamic calendar, thus placing us in the 15th century, while the Jewish calendar notes that the year is 5760 which is in the 58th century, not the 21st.

Given its relativistic nature and not wanting to be deluged with celebration, commentary or general millennia madness, I sought refuge remote from my home. My wife and I traveled half way around the world to Hanoi. I expected that in the milieu of Vietnam with its history of Confucianism and Buddhism and a government that holds an independent world view, that midnight on December 31st would pass quietly with just another tick of the clock.

How mistaken I was! On that night, in the center of Hanoi a great celebration took place accompanied by the sound of a thousand drums beating in unison. I discovered that the dawn of the year 2000 was being greeted with awe and wonder by all peoples of the planet. In fact, information technology provided an unprecedented worldwide sharing of that event.

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Признателност към делото на Св.св. Кирил и Методий

На 7 април 2000 г. на тържествена церемония в Аулата на нашата Alma Mater бе присъдена научната степен ПОЧЕТЕН ДОКТОР НА СУ „СВ. КЛИМЕНТ ОХРИДСКИ“ на проф. Едуард Фригман, професор по мениджмънт на технологиите в Технологичния институт „Стивънс“¹, щата Ню Джърси, САЩ, и директор на неговия Център за усъвършенстване на обучението по природни науки. В резултат на сътрудничеството на проф. Фригман с Института по математика и информатика към БАН и Математическия факултет към Софийския университет са разработени и експериментирани учебни материали и съвременна методика за обучение с използване на съвременни компютърни технологии. Проф. Фригман иницира проект с участие на редица български училища, за които е доставена безплатна техника, необходима за работа в Интернет. Той проявява изключителна съпричастност и практическа ангажираност към съдбата на млади български математици. Още от началото на научноизследователските си контакти с българските учени и преподаватели проф. Фригман активно съдейства за ефективно сътрудничество в областта на образованието между САЩ и България.

По време на тържествената церемония проф. Фригман произнесе академично слово „Едисон и Св. Кирил - в търсене на общото“, което помества с разрешение на автора и с любезното съдействие на Отдела за връзки с обществеността към СУ „Св. Кл. Охридски“.



Ректорът на СУ „Св. Кл. Охридски“ проф. Б. Биолчев и проф. Е. Фригман по време на тържествената церемония в Аулата на най-старото висше училище у нас.

ЕДИСОН И СВЕТИ КИРИЛ - В ТЪРСЕНЕ НА ОБЩОТО

Уводни бележки на благодарност и признание

През последните месеци се опитвах да не слушам високопарните речи за новото хилядолетие. Инстинктите ми на физик и математик ми казват, че този възглед за времето е относителен. Все пак това е 1420 г. по ислямския календар (което ни поставя в 15-и век), докато еврейският календар отбелязва, че годината е 5760 (което е 58-и век, а не 21-ви).

Поради относителната му природа и за да не бъда потопен в празненствата, коментарите и все-

Проф. Едуард Фригман, дфн

общата лудост по новото хилядолетие, потърсих убежище далеч от дома си. Със съпругата ми обиколихме половината свят, за да стигнем в Ханой. Очаквах, че наред с Виетнам, където Конфуцианството и Будизмът имат дълбоки корени и където правителството отстоява независим възглед за света, полунощ на 31-ви декември ще премине тихо, просто с още едно тиктакане на часов-

¹Информация за Технологичния институт „Стивънс“ може да намерите в ИНТЕРНЕТ страницата: www.stevens-tech.edu и в електронното списание *Stevens Views* на адрес: <http://stevensviews.stevens-tech.edu>.

It is with an intensified sense of all peoples living in a closely connected world that I speak with you today. While the world is moving toward a common culture, there remain distinct national traits that have special value. In particular, Bulgaria and the United States have attributes that underlie significant national characteristics. Perhaps we can learn from each other and thereby strengthen the vitality of both countries.

With that perspective, I look back to my first visit to Bulgaria in 1991. At that time, I was invited to speak at Sofia University at a Symposium on Bulgarian-American relations. The early 1990's were a period of great change and transition in Bulgaria and throughout Eastern Europe. During that period of changes in social organizations and government, I was asked to speak about some aspects of American society that I thought would be meaningful to an audience in Sofia. A significant part of my presentation in 1991 dealt with Thomas Edison. I chose Edison because he epitomizes essential features of American society. Edison was a great inventor who was driven to create new technologies. He did this with an obsessive concern for practical results. While employing scientific knowledge and scientific methods, he was not interested in knowledge for its own sake. Edison was the quintessential pragmatist.

Having since visited Bulgaria on several occasions, as well as having had the pleasure of welcoming numerous Bulgarian colleagues to the United States, I have come to learn something about your country and your culture. The contrasts that I have observed with aspects of pragmatism and materialism in American society are striking.

A memorable occasion for me was in May of 1995, when I witnessed the National Celebration of Bulgarian Education and Culture. I walked from my hotel to the National Library where preparations were taking place. *En route*, I had the pleasure of encountering thousands of school children with flowers in their hands walking to the Library with their teachers. At the library, there was a marvelous musical performance and speeches about the significance of the lives of Saints Cyril and Methodius in Bulgarian history. I was impressed to see not only the leadership of the country assembled there, but lined up to participate in the laying of flowers at the base of the statues of Saints Cyril and Methodius, was the entire Diplomatic Corps. Representatives from many nations were present and each held a bouquet of flowers for the ceremony. Given the array of parliamentarians, ministers, diplomats, generals and other august figures who hold power in society, I was astonished to see how the formalities evolved. The leader of the procession who strode in front of all these dignitaries was the Principal of the Classical Language High School!

Here then was a moment of national celebration that was remembering and honoring the creators of the Slavonic Alphabet in a manner that gave precedence and honor to those who were preserving traditional culture. This was an explicit statement that Bulgarian culture was grounded in language. The very fact that a great national day would take place at a library was in itself remarkable to me. To see the teachers and schools given precedence before politicians and generals was another exceptional occurrence. While you may take the manner in which this national holiday is celebrated as normal, you should be aware that for most of the world and particularly the United States, such a public veneration of language and learning is without parallel.

Returning to the time of my first visit in 1991, you recall that it was a period of tumultuous change. Statues and artifacts representing Communism were being removed and names of boulevards were being changed. Every public surface displayed posters announcing English language courses. Here and throughout Eastern Europe, there was preoccupation with the end of a period of history characterized by competition and conflict between East and West. What was called the Cold War was over and a new era was emerging.

Looking back at these events of a decade ago, I have come to believe that the perspective of the early 1990's was limited. Many saw those changes as an end of the struggle between Capitalism and Communism and the beginning of a period of universal adherence to shared social and economic principles.

Indeed it is the case that many political systems have changed. While those changes have been dramatic and profound, experience of that last decade illuminated more fundamental areas in which values are not shared. What can be seen more clearly in this post-Cold War era is that there are at least two conflicting sets of values with which we all must grapple. These are the struggle between Democracy and Authoritarianism and that between Humanism and Materialism. These competing modalities have always been with us, but they can be seen with greater clarity because they are not obscured by intense competition between political ideologies. These struggles are not necessarily between nations, but exist within each country, competing for dominance.

I would like to discuss some narrow aspects of the dichotomy between Humanism and Materialism. My attention is limited to some examples of how these cultural attitudes affect education, the development of technology and the emergence of new enterprise within a nation. Those of us who are active in fields of mathematics, science and informatics can have some impact in this domain through our work, our contact with students and our interactions with the broader society in which we live.

Both the United States and Bulgaria are complex and multifaceted societies, but there are unique traditions of materialism indigenous to the United States and unique traditions of humanism indigenous to Bulgaria that I am addressing in this talk.

By Humanism, I refer to the values and traditions in a society that are focused on individuals. These include spiritual life, interpersonal relationships and the life of the mind. It is in this later realm that the veneration in Bulgarian society for the contributions of St. Cyril that expanded access to the written word, is of fundamental significance.

In American society, the work of Edison was directed at external aspects of human existence. He worked to create artifacts, new technologies, systems and organizations all driving toward a more comfortable and productive life and the creation of personal and corporate wealth. The role of technology was central to all of Edison's endeavors. Edison was basically a pragmatist who was devoted to materialistic enterprises.

Edison's inventions contributed to improvements in the quality of human existence, but value judgements about his preoccupation with technology deserve scrutiny.

The late Melvin Kranzberg, who was a leading American Historian of Technology once said: "Technology is neither good nor evil. Nor is it neutral." How societies make judgments about these issues is crucial in a world that is increasingly driven by technological change and which is also rife with competition. The consequences of striking a particular balance between aspects of Humanism and Materialism are significant. In grappling with these challenges, it may be worthwhile to examine the history and nature of American pragmatism more closely.

One might argue that the pragmatism found in the United States in pursuit of technology and material well-being is not unique to that country. After all, there are engineers in countries around the globe who share a love of the practical and utilitarian. Why is the United States special? In the short time that we are together,

I would like to present a few suggestive thoughts to support this thesis.

The United States is a young country that frequently turns to the attitudes, opinions, writings and philosophy of its so-called "Founding Fathers." This is most commonly done in the field of law, where our courts are constantly analyzing and seeking to interpret our Constitution in terms of the intentions of those who created it. The Founders also provide inspiration for life in the contemporary world. We are a country that was blessed with great leaders whose

foresight has been quite remarkable. They framed a social order that endures with great resilience in an era in which the realities of daily life are incredibly different from those in the Colonies of the late 18th century.

Pre-eminent among our early leaders was Thomas Jefferson, the third President of the United States, and a principal author of the documents upon which our nation is founded. Jefferson was not only a leader in political society, but he was an inventor and a scholar. His library was the most outstanding in the American Colonies and, through his initiative and generosity, became the basis for our national library, known as the Library of Congress that today is one of the greatest libraries of the world. Jefferson's love of learning was deep and he founded what is today one of the leading institutions of higher learning and research in the United States, the University of Virginia.

How then does this great intellectual enter into this presentation on American pragmatism and technological materialism? The connection can be seen in his own handwriting. He was a prolific writer and, in fact, invented a pantograph that automatically made copies of all of his hand-written documents. He was a harbinger of the great contemporary passion for photo-copier machines.

The sense of awe in which Jefferson's intellect is held in America, was illustrated in a statement made by former American President Jack Kennedy. Kennedy had invited American Nobel Prize winners to the White House for an event in their honor. Before the assembly of Nobel Laureates, he said that there had never been such a concentration of brain power in that room of the White House since the time that Thomas Jefferson dined there alone.

On June 18, 1799, Thomas Jefferson wrote to a young friend words of advice about how to prepare for future endeavors. He said this about the role of mathematics in life's pursuits:

"Trigonometry, . . . is most valuable to every man, there is scarcely a day in which he will not resort to it for some of the purposes of common life; the science of calculation also is indispensable as far as the extraction of the square and cube roots; Algebra as far as the quadratic equation and the use of logarithms are often of value in ordinary cases: but all beyond these is but a luxury; a delicious luxury indeed; but not to be indulged in by one who is to have a profession to follow for his subsistence."

Jefferson goes on to enumerate some of these luxuries that should be avoided by all people who must work for a living. They include:

". . . the conic sections, curves of the higher order, perhaps even spherical trigonometry. Algebraic operations beyond the 2nd dimension, and fluxions." (fluxions are known today as differentials)

Jefferson continues in that letter with a description of topics in science that are useful and others that are, in his words, “. . . a matter of luxury.”

These attitudes, I contend, have shaped American thinking and educational programs during the past two hundred years. Jefferson was a prominent example of a tradition of pragmatism that is deeply embedded in American culture. A century later Thomas Edison emerged as an icon of American ingenuity. There is ample evidence that Thomas Edison was devoted to practical knowledge and eschewed the theoretical.

Edison was famous for his many inventions including the incandescent light, the phonograph, and cinema. He not only invented artifacts but was a genius in conceptualizing and implementing systems including the first operational electrical power company for an urban environment. One of his greatest inventions was the process of invention itself. He established the first large, systematic and productive research and development laboratory in the world. The extraordinarily productive contemporary research laboratories of the General Electric Company and the prolific facilities at Bell Laboratories, now run by AT&T, are direct outgrowths of Edison's model.

While he was extremely capable in applying scientific methods to the systematic development of innovations, he did not seriously pursue the study of science himself. This proved to be a serious impediment to his success. Edison entered into a fierce competition for control of the emerging electric power industry with George Westinghouse. Westinghouse was promoting alternating current systems and Edison was promoting direct current systems. Unfortunately, Edison had not studied the theories of electrical induction and was unable to grasp the principles of alternating current. Since his understanding of electricity was limited to steady currents, he was at a disadvantage that proved decisive. The scientist and inventor Nicola Tesla tried to help him but without success. As we know, Westinghouse prevailed.

I must pause to note that after I drafted these remarks, I learned that Nicola Tesla, who was born in the Balkans and who became an American citizen, was a prior recipient of this Honorary Degree from Sofia University!

One might think that Edison's lack of understanding of electrodynamic theory was due to poor early schooling and lack of time in later life to engage in serious study of the subject. However, his disdain for theoretical science and an outlook that favored Jefferson's categorization of many intellectual pursuits as luxuries was well known. For example, upon learning that his youngest son, Theodore, showed an interest in mathematical physics, he stated, in 1923, to a reporter from the New York Times:

“Theodore is a good boy, but his forte is mathematics, I am afraid he may go flying off into the clouds with that fellow Einstein, and if he does...I’m afraid he won’t work with me.”

Edison was dismayed by this prospect of his son pursuing theoretic science—off in the clouds.

In examining our own era, it is increasingly obvious that the greatest transformations in society are being driven by computer technology. In reviewing how this remarkable technology evolved, it is certainly the case that traditional academics played crucial roles. An outstanding pioneer was the physicist and mathematician of Bulgarian heritage, John Vincent Atanasoff, who created the first working model of a digital circuit with vacuum tubes in 1941. He did this work while at Iowa State University. The early development of large machines took place at other academic environments. MIT and the University of Pennsylvania were among the first centers for development of mainframe machines. Key players included leading scholars with the most notable being Von Neumann.

But the great leap forward in information technology took place in a totally unexpected manner. No one had anticipated the development and the future importance of personal computers. An examination of the science fiction literature of the 1970’s reveals that the future of computing was imagined exclusively in terms of larger and more gigantic machines. Certainly, the business plans of organizations like IBM did not anticipate the advent of desktop, laptop or handheld computers or large networks of small computers.

This transformation from large to small machines evolved with astonishing rapidity in the early 1980’s through the inheritors of Edison’s spirit and drive. The two most significant figures who were instrumental in moving these changes forward were Steve Jobs and Bill Gates. Both of them are at their core pragmatic inventors and entrepreneurs. Neither was a college graduate. Jobs left his studies at Reed College to develop microcomputers and Gates discontinued his studies at Harvard College to develop software for microcomputers. Both created new enterprises and new visions for society. The Apple computers of Jobs and the Microsoft software of Gates provided the cornerstones for the incredible development of Silicon Valley.

The region between San Francisco and San Jose in California is a mega version of Thomas Edison’s invention factory. The spirit of Edison permeates the environment. A new element has been added as an essential ingredient in these rapid developments – the raw material for a materialistic culture – venture capital. The willingness of financiers to invest in new enterprise is as much a part of the creative process as the research and development laboratory.

While Silicon Valley is quintessentially American in its pragmatism and entrepreneurial enthusiasm for new enterprise, it is not a place that is only for Americans. Silicon Valley is an Invention Micro World in which people from all over the planet are now active players. Probably a majority of the most creative people there are from countries other than the United States, including Bulgaria. With the creation of these new inventions, is the obsession with material gain dominant or can a broader vision prevail?

I pose this question in a beautiful hall that we entered after being treated to a vision of Saints Cyril and Methodius. The impressive stained glass windows with their images are an effective reminder of Bulgarian educational values. In a University named for Saint Clement, the disciple of Cyril and Methodius, fundamental values of humanism are held up for all of us to contemplate.

Upon learning of the honor that you are bestowing upon me today, I went to the Sofia University web site to learn more about this great institution. I was struck with how the University begins the story of its history with an account of the development of education in the ninth century that was inspired by these Saints who are commemorated in icons, windows and statues throughout the country.

The Saints Day of St. Cyril and Methodius is celebrated not only with direct reference to and veneration for the printed word, but is closely tied to the annual cycle of learning. That day and its associated observances come at the end of the school year. It may not be obvious to those of you who take these values for granted, but a society that celebrates formal learning, with roots that go back eleven centuries, is unique in today's world. Clearly, it is quite different from American society in which classical education was, for much of its history, considered a luxury only for the wealthy and idle classes.

The love of learning in Bulgaria is deeply embedded in the culture. I vividly recall being startled by the sight in Sofia on the first day of school in September when thousands of students were dressed up as if going to a party, carrying flowers for their teachers. On that day the automobiles and cars had their lights on in celebration of the opening of the school year. In addition, I am told that families feel a sense of happiness that they themselves are returning to school when a youthful child from their household embarks upon the first day of schooling.

While St.'s Cyril and Methodius and their successor St. Clement are associated with the world of letters, it is really the full domain of scholarship that is revered. Fundamental in this panoply of learning is mathematics—a field in which Bulgarians have excelled with phenomenal regularity.

It is not accidental that Bulgarian educators had the genius and insight to develop educational programs, more than two decades ago, to treat acquisition of knowledge in a unified manner. Mathematics, informatics, language study and art were all seen as manifestations of coding or systems of representation.

In today's scholarship at Sofia University, the design of software for instructional applications is seen as inextricably linked with linguistic operations. The spirit of St. Cyril is as much in the mathematics classroom as in the literature salon. The reverence for the life of the mind shapes mathematics education in Bulgaria in a distinctive manner. American mathematics educators often engage in asking students superficial questions that can be solved in a few minutes. Bulgarian mathematics educators delight in challenging students with questions that require extended analysis. When Bulgarian students succeed they are then given a more complex problem. In America when students solve their problems they are encouraged to go on to a new subject.

I once asked a Bulgarian mathematician why he was developing a journal for secondary school students. He answered that he wished students to have a greater appreciation for the beauty of mathematics. In America, if there were a mathematics journal for secondary school students, the answer would more likely have been to show students how mathematics is useful in the workplace.

A society that is purely materialistic will undoubtedly encounter serious problems. I am troubled by the extent to which young Americans are focused on wealth as an end in itself. While that is a major trend, there are bright spots. I have recently become aware of efforts in Silicon Valley among successful entrepreneurs in their late twenties and early thirties to encourage philanthropy. They are talking among themselves about the importance of giving their millions away while they are young!

Here in Bulgaria we know that many young people have left the country in response to the attraction of places like Silicon Valley, but many stay and the classical values of Humanism are still embedded in society.

The challenges that I see are for Bulgaria to absorb some of the entrepreneurial, pragmatic magic of American society that leads to new productive enterprise and for America to value more deeply the Humanistic traditions exemplified in the culture of Bulgaria.

I am an optimist and believe that civilization, despite its setbacks, continues to improve. I would like to close with a passage from that same letter by Thomas Jefferson that I referred to earlier. He wrote:

“I believe that... (the human) mind is perfectible to a degree of which we cannot as yet form any conception... science can never be retrograde; what is once acquired of real knowledge can never be lost. To preserve the freedom of the human mind... and freedom of the press, every spirit should be ready to devote himself to martyrdom; for as long as we may think as we will and speak as we think, the condition of man will proceed to improvement.”

By providing me with this honor and by our sharing these moments together, I hope that we are helping bring together the best of both of our societies. With thanks to you all.