

## **REFLECTIONS ON EDUCATION**



# Ismail Serageldin

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**ON EDUCATION AND THE FUTURE OF THE ARAB WORLD**

*Remarks delivered at The Royal Society, London  
14 November 2013*

**TOMORROW'S UNIVERSITIES AND THE SEVEN PILLARS OF THE  
KNOWLEDGE REVOLUTION**

*Essay prepared in 2013*



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## TOMORROW'S UNIVERSITIES AND THE SEVEN PILLARS OF THE KNOWLEDGE REVOLUTION

*Essay Presented at the Berkley's Conference on:  
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2 October 2013*



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## FOREWORD

On November 14<sup>th</sup>, 2013 the Alexandria Trust arranged a special evening at the Royal Society in London to honor Professor Ismail Serageldin, where he delivered some interesting remarks on the topic of our common interest, namely education and the renewal of the Arab World. His remarks covered partly what has been going on in Egypt and the Arab World since the Arab Spring, and observations on the role of education in Arab renewal, and the manner in which education is changing globally at the present time. The remarks were extremely well received by the distinguished audience, and many asked for a copy of the text. Dr. Serageldin kindly agreed to let the Trust issue a published version of the remarks. These constitute the first part of this document, under the title “On education and the future of the Arab World.”

However, since many of the ideas on the transformation of education and the changing role of the university that he touched upon in his remarks

are more carefully articulated in a manuscript he had prepared on the global university, and we wanted to provide that information to the readers of the remarks, that second paper is also included in this volume under the title “Tomorrow’s Universities and the Seven Pillars of the Knowledge Revolution.”

The volume also includes a brief biographical profile of the Author and short introductory statements about the Alexandria Trust and Macat. In issuing this little volume, the Alexandria Trust is confident that it is advancing the cause of education and the Arab world.

Salah Khalil

Founding Trustee, Alexandria Trust &  
Founding Director, Macat International

## INTRODUCTION

It was a pleasure to meet Dr. Ismail Serageldin during his recent passage in London, when the Alexandria Trust organized a special event for him at the Royal Society. On that occasion we discussed many issues including those pertaining to the state of the Arab World , especially Egypt, after the Arab Spring and the subsequent developments that have gone from turbulence in some countries to outright civil war in Syria. But we quickly focused on our common interest of education. Here I found much of what he has to say to be of great interest. I am happy that in addition to his remarks at the Royal Society, this little book also encompasses his longer reflections on the revolution in the management of knowledge and its impact on education generally, and on universities more particularly, in the years to come.

The substance of the argument that Dr. Serageldin is advancing is that the Information and Communication Technologies (ICT) revolution is

more than accelerated communication and putting printed pages onto digital formats on screens. He argues that it is a profound qualitative change into how knowledge is generated, organized, kept and retrieved, and that this qualitative transformation is so profound that it will change many many things. While I would not go quite as far as he does in considering it as profound a transformation as the invention of writing, I do agree that he makes a compelling case for the extraordinarily powerful qualitative nature of the transformation, so much so that it will have continuing major impacts on many aspects of our lives, including on the manner in which future generations will be educated. His “Seven Pillars of The Knowledge Revolution” deserves the closest scrutiny.

Dr. Serageldin’s vision of the future is far from dystopian one. He sees the promise in almost every aspect of the transformations that he records or expects to happen. Bu there is in both his remarks at the Royal Society and his essay on education and the universities of the future a highly appropriate refusal to accept the notion that any change should be embraced simply because it is new. It is a welcome and necessary complement to his generally positive message about the potential

benefits of change. Not every innovation is an improvement, and in the process of change there is a great deal to protect in the legacy of the past. That said, the challenge, as Dr. Serageldin sets out clearly, is to use the ICT revolution to improve our education, so that people can better become the masters of change, rather than its victims.

Dr Serageldin is a person of charm and intellect and possesses enormous erudition and vast experience. He is an astute and articulate observer of society, technology and education. His voice is one that deserves to be more widely heard, and I am delighted that the Alexandria Trust is contributing to that goal by publishing this little book.

Rt Hon. Charles Clarke

Former UK Education Minister



**ON EDUCATION AND THE FUTURE OF  
THE ARAB WORLD**





## INTRODUCTION

Ladies and gentlemen,

It is a great honor to find myself in these historic premises, in the bosom of one of the greatest institutions of learning that the world has known, surrounded by such an august gathering of wonderful people, all of whom I admire, and many of whom I not only know but am proud to consider my friends.

My thanks to our host, the Alexandria Trust, represented here by the chair of its board of trustees, Emma Playfair, and by its founder Salah Khalil for having made this possible. I am of course partial to the Alexandria Trust, as it not only shares the affinity of name with the Great Library that I now head, but also because it shares a vision and commitment to education and learning as the way to improve and even transform societies.

The trust was launched in 2011 by the youthful Egyptian philanthropist Salah Khalil and a group of Arab business leaders, who are determined to

make a difference to education across the Arab region, to get it one day, to recapture the legacy of ancient Alexandria as a world leader in education and learning.

Salah Khalil is also implementing on a separate track a truly ambitious project to present the seminal books of all disciplines of learning in a new way that makes it accessible to today's learners, and also will be providing it in Arabic. An awesome vision that deserves our support.

But at the trust and in the Library of Alexandria, we all share a vision that education and learning can best flourish in a climate of academic freedom and enquiry in every discipline and at all levels, and that the product of such an education is a young person equipped with an enquiring and critical mind, the ability to relate well to others and a confidence in their place both as active citizens and productive workers.

But clearly my friends, this is not happening in Egypt or in the Arab World today. So let me take you on a journey into the tumultuous events in our part of the world, and in Egypt more particularly, before we get back to some issues on the substance of education:

## BIRTH PANGS OF EGYPT'S NEW REPUBLIC

As you all know, this has been the “Arab Spring”. Ordinary citizens have toppled autocrats and still battle dictators armed with little more than their convictions. Ultimately, they cannot be denied. For as Victor Hugo has said: “No army can defeat an idea whose time has come”. And freedom, human rights and democracy are ideas whose time has come for even the most remote corners of the globe.

The youth in our part of the world have led the uprisings, they are the embodiment of the unconquerable spirit described by Henley's *Invictus*:

*It matters not how straight the gate,  
How charged with punishments  
the scroll,  
I am the master of my fate,  
I am the captain of my soul.*

This surge for freedom, reminiscent of the best in human history, will face setbacks to be sure. But ultimately, it must triumph.

The Egyptian Revolution corrected its path on the 30th of June 2013 when unprecedented

numbers of Egyptians, in their tens of millions, signed individual declarations asking President Morsi to step down, and took to the streets and said “No” to the rule of the Muslim Brotherhood. In the face of this overwhelming public disavowal of the government and in the absence of a formal procedure to impeach the president, the army joined the leaders of the opposition, along with the religious leaders of the country and the judiciary, to force a change of government. It was no coup, it was a genuine people’s revolution.

Regretfully, violence has now reared its ugly head in what was largely a non-violent revolution since the 25th of January 2011 and renewed on the 30th of June 2013 by largely peaceful demonstrations. Many people have been killed. A historic and largely joyful process for most Egyptians has been marred by the horror of the violence, the agony of the wounded, the finality of death and the grief of the mourners.

We need a full investigation to clarify what happened, and find the guilty in all acts of violence since 25 January 2011. Every attack, every death, has to be accounted for professionally, transparently and in the context of the law.

Egypt has turned a page and is writing a new chapter in the history of its second revolution. Sadly, part of that is now written in blood. Along with others, I decry all loss of life, and I warn that censorship is still a breach of free speech that should be resisted. I have called for national reconciliation of all Egyptians. That is the path for the future. But emotions are running high, and few are willing to listen to this appeal at present.

And today if in Egypt the people have shown that they could be moved in their millions to reject the Islamist future promoted by the Muslim Brotherhood, they must equally avoid the returning specter of the autocratic state. In their eagerness to reject the past, to bring law and order, there is an unhealthy willingness to move towards looking for a charismatic savior and a centralized state. History shows that this is not the path to building democracy. It is good to remember the famous statement by Lord Acton: “Power corrupts and absolute power corrupts absolutely.”

But systems of governance are not born perfect. They are built by the exercise of political participation and the experience of defining the boundaries of the acceptable.

Like everywhere else there are many obstacles to the advance of democratic practice, even after the principles of democracy have been accepted.... Powerful interests defending their privileged position, competing ideologies, uncertain loyalties, corruption .. all mean that every society moves towards its democratic ideal slowly.. two steps forward, one step backward...

But despite these caveats, I believe that in my part of the world powerful Islamic zealots are still the biggest risk to implementing our dreams of a democratic society and promoting freedom of expression in art and science.

But I am confident that the amazing spirit of Egyptian youth will shepherd our nation towards openness, freedom and the rule of law. But for youth to reach the full promise of their abilities and to be able to give the full measure of their talents, our education systems must be totally overhauled, hence I return to the opening theme of these remarks: Education, and I mean education in the broadest sense.

## EDUCATION

Education is the lifeblood of societies. It is a broad societal affair involving parents, teachers, society at large and the younger generation itself. For it does more than the transmission of the cumulative knowledge of the past to a new generation, it actually provides the tools and the attitudes that make youngsters lifelong learners, for knowledge is not frozen in a particular set of schoolbooks at a particular time. Education socializes youth on relating with their peers, and helps them internalize the values that make them effective citizens and teaches them how to interact in the rough and tumble of the marketplace of ideas. Above all, it introduces them to the profound ethical constructs that they will carry into the journey of their lives behaving as good human beings.

However, that is not what happens in most of our schools today. Furthermore, the existing model of education, even in the West, under the heading socialization tries to enforce certain qualities deemed important by future employers. Schools in fact teach children the discipline to endure boring and repetitive tasks that they get graded for mastering better and better. Their natural tendency

to communicate with their peers, to run and play is curbed, by being told to “sit still and be quiet”. If they do not take easily to that regimen, they are now treated for Attention Deficit Disorder and even given drugs to assist them to comply. They have to stay hours listening to an authority figure, in a setting that is rarely a beautiful architectural space, on a chair and desk that are that are rarely particularly comfortable furniture.

The student learns to be docile and to respect authority and to manage to do repetitive and boring tasks effectively. The implicit model is to train workers for boring repetitive tasks in factories or offices, something the industrial economy of the 20th century clearly demanded, despite its dehumanizing aspects so effectively portrayed by Charlie Chaplin in “Modern Times”.

However the globalized modern economy is rapidly changing, and robots are more likely to take over the more repetitive aspects of jobs in the future. We already see this clearly on the assembly lines of the automotive industry, being followed by industry after industry. Likewise, in offices tasks like data entry and checking are also increasingly being taken over by computers. The future will be for a lot more collaboration between humans and



machines, and thus we must question all aspects of the educational enterprise that we have inherited from the last century. No matter how successful they have been, the policies of the past are rarely the best to confront the challenges of the future.

Education is likely to change profoundly in the coming decades, in terms of content, participants, methods, and organizational setting. But that kind of issue will take us into a more technical discussion, that for tonight I would like to avoid in favor of a broader, more philosophical, perspective.

And I will not get into the specifics of how ICT is transforming social relations and educational enterprises. From Massive Online Open Courses or MOOCs and flipped classroom instruction in Universities we have come a long way since the UK pioneered the Open University some 45 years ago. And we still are rushing headlong into a wonderful if unknown future. Facebook and twitter have redefined the notion of peer groups and communities bringing more and more of our contacts through the world of the internet.

But are we not losing something valuable here? I will not talk about the value of longer attention spans, rather, I want to go back to fundamentals about knowledge and self-knowledge. Data when

organized becomes information, which when explained becomes knowledge. But our human societies need more than knowledge, they need wisdom. That requires time, reflection and the patina of experience. Thus we very much need the insights of the social sciences and the wisdom of the humanities in addition to the knowledge of the natural sciences.

Regretfully, the gap between the social sciences and the humanities on the one hand and the natural sciences on the other, remains vast, especially in our part of the world.

### THE “TWO CULTURES” REVISITED

When C.P. Snow wrote about “the two cultures” over half a century ago, he bemoaned a degree of ignorance, even rising enmity between the culture of science and the culture of the humanities. The ignorance of each about the other was noticeable then and has grown since. Today, that non-science culture has mutated into a variety of groups, all sharing the same level of ignorance about the basics of science. Some are gravitating towards a fundamentally anti-science posture. Many deny that science is anything more than just another

discourse reflecting the power relationships of society, and that its practitioners, the scientists, are no more than another social group vying for resources and power. They politicize debate and reject evidence.

Yet Science is different. We lose sight of that difference at our own peril. In science, there is no individual authority, no book that governs right or wrong, no high priests that interpret the sacred texts. There is a method. A method based on rationality and evidence. Science encourages the engagement with the contrarian view, and hails the overthrow of existing paradigms and conceptions as breakthroughs. Most of the innovators in science are very young. Einstein was 26 when he published his revolutionary papers in 1905. Watson was 25 when he co-discovered the structure of the double Helix. All were hailed for their discoveries and are in the pantheon of the greatest scientists.

But powerful as the empirical scientific method is, it is not enough to deal with many of our problems, which are not just individual or systemic, but also social and environmental, local and global. We need the insights of the social sciences and the

wisdom of the humanities. We need to bridge the two cultures more than ever before.

The methods of the mainstream social sciences may differ from those of the natural sciences, but their scholarship is not in doubt. Usually more qualitative than quantitative, the social sciences tend to description rather than prescription, and avoid generalizations across societies, with the obvious exceptions of cross-sectional economic studies.

Their tools include the study of narrative, which is a very powerful tool. For example, it is very difficult to come to grips with conflicts within or between societies without understanding their different historical narratives. It is impossible to deal with the Palestinian-Israeli issue if you do not recognize their totally different historical narratives, or to understand the problem of Race in America, or the post-colonial context in many places.

Thus, if we cannot aspire to be moving to a unity of knowledge as suggested by some, most notably E.O. Wilson in his *Consilience*, we can aspire to reject the growing chasm between the two cultures and promote pluri-disciplinary work.

At present, many of the problems of our time, from gender to medical issues, from the deployment of technology to environment, from social cohesion to international peace, focus attention on human individuals and societies as much as on the natural world we live in. Human beings are social beings, living things that have motives, intentions, norms and values, whose social institutions have meaning symbols, rituals and cultures... All of that is not directly measurable, but has to be inferred from observations. These are precisely the contributions of the Social Scientists. For the benefit of humanity in this new century, we must bridge the rift between the two cultures. We must be able to bring their different and complementary insights to bear on the great problems of our time.

Allow me now to turn to Values.

### **VALUES & THE VALUES OF SCIENCE**

When we talk of values, the Library of Alexandria is dedicated to the pursuit of knowledge and the promotion of dialogue and understanding, between cultures and within cultures. We confront the currents of obscurantism, fanaticism and xenophobia with a steely determination to

uphold the values we hold dear, among which are the respect for human rights, rationality, the maintenance of a civil discourse and the promotion of personal freedoms, especially the freedom of expression. These are the basic building blocks of democratic systems.

Today there are those who still fear that the Arab Spring will give way to the Islamist winter. That the idealism of the revolutionary democrats will only pave the way for theological autocrats. Yes, Islamist sentiment is strong and zealotry is expanding in parts of the public realm. But the defense against extremism is not by censorship or autocracy; it is by embracing pluralism and defeating ideas with ideas.

And here Science has much to say. Especially through what I call the Values of Science.

Science has much to say to the Islamist zealots who preach an intolerant doctrine.

It has much to say to young democrats enamored of the new technologies.

It has much to say to those who yearn for a better economic future.

And more importantly, it has much to say about the kind of values that we must adopt if our

societies are to be truly open and democratic, for these are the values of science.

To the Islamists, who yearn to return to their particular vision of the Muslim past, we say, there is a great Arab and Muslim tradition of science and tolerance that you must be aware of. Indeed, throughout the dark ages it was the Muslims who held up the torch of rationality and reason, while Europe was in the throes of bigotry and intolerance.

Centuries before Bacon, Descartes and Galileo, Ibn Al-Haytham (10th C) laid down the rules of the empirical approach, describing how the scientific method should operate through observation, measurement, experiment and conclusion:

“We start by observing reality ... We then proceed by increasing our research and measurement, subjecting premises to criticism, and being cautious in drawing conclusions... In all we do, our purpose should be ... the search for truth, not support of opinions” .

Likewise, listen to the voice of Ibn Al-Nafis (13th C) on accepting the contrarian view, subject only to the test of evidence and rational analysis.

“When hearing something unusual, do not preemptively reject it, for that would be folly. Indeed, horrible things may be true, and familiar and praised things may prove to be lies.”

This is the Muslim tradition that must be revived if the Arab World, Muslim and non-Muslim alike, will indeed join the ranks of the advanced societies of our time. Rejecting politicized religiosity, and reviving these traditions would promote the values of science in our societies.

To the youth, enamored with new technologies or simply seeking a better economic future, we say: remember science and the scientific method, for it is scientific insight and knowledge that gives birth to technology. We must be the producers of knowledge not just the consumers of technology. That will not happen unless we open our minds to science and the scientific approach and open our hearts to the values of science.

What are these values of science that I keep returning to as the basis for enhancing human capabilities and ensuring the public welfare?

As Bronowski observed more than half a century ago, the enterprise of science requires the adoption



of certain values: Truth, honor, teamwork, constructive subversiveness, engagement with the other, freedom, imagination, and a method for the arbitration of disputes. The values of science are adhered to by its practitioners with a rigor that shames other professions.

**Truth** Any scientist who manufactures his data is ostracized forever from the scientific community. She or he may err in interpreting the data, but no one can accept fabrication of data. In no other field of human activity is this commitment to truth so absolute.

**Honor** Scientists reject plagiarism. To give each his or her due, is essential, a sentiment well captured in Newton's statement that ... "if I have seen farther than most, it is because I have stood on the shoulders of giants".

**Teamwork** has become essential in most fields of science. And the essence of teamwork is to ensure that all the members of the team receive the recognition that they deserve.

Science advances by overthrowing the existing paradigm, or at least significantly expanding or modifying it. Thus there is a certain **constructive subversiveness** built into the scientific enterprise,

as a new generation of scientists makes its own contribution. And so it must be. Without that, there would be no scientific advancement. But our respect and admiration for Newton is not diminished by the contributions of Einstein. We can, and do, admire both. This constant renewal and advancement of our scientific understanding is a feature of the scientific enterprise. It requires **tolerant engagement** with the contrarian view, accepting to arbitrate disputes by the rules of evidence and rationality.

Science requires **freedom**: Freedom to enquire, to challenge, to think, to imagine the unimagined. It cannot function within the arbitrary limits of convention, nor can it flourish if it is forced to shy away from challenging the accepted.

The content of the scientific work is what is discussed, not the person who produced it, regardless of their nationality or the color of their skin or the god they choose to worship or the ethnic group they were born into or their gender. These are societal values worth defending, not just to promote the pursuit of science, but to have a better and more humane society. These are the **central**

**core of universal values** that any truly modern society must possess.

### THE ROLE OF EDUCATIONAL INSTITUTIONS

The role of educational institutions in this domain of values is particularly important. For they have a unique double responsibility. Universities are both the custodian of the past and the inventor of the new, not just in terms of the socialization function and the societally approved behavior of citizenship, but in terms of values and culture. Cultural identity and the meaning and role of our heritage are part of it. History, archeology, cultural studies are all part of learning about our past and maintaining our heritage. But universities are very much the palaces where the young learn to challenge the existing and the inherited, to seek novel answers and to invent the new. Thus it becomes the locus of challenging the status quo, and sows the seeds of innovation, whose products and constructs will become the heritage of the future. That double process of preservation and renewal, of authentication and opening up to the foreign and the new, is one of the unique functions of the university, which will remain and will be expanded in the future.

The Values we hold define who we are. The Values of Science are essential, but we also need to ensure democracy and freedom for all. We also need to address issues of Social Justice, of Participation, of Social cohesion, mobility, justice and pluralism. These values, taken together with the values of science, will help define a truly democratic society, where each can blossom to his or her full potential, and give to the full measure of their abilities and talents.

Values create a society out of a collection of individuals. Values enable transactions to take place and bridge the inter-generational divide. Values are what make a human society worthy of the designation “human”. We have come to rely on our educational system to reinforce what parents do at home in nurturing the correct values in their growing children. In the educational system, values are forged by teacher example and student practice.

Values include providing youth with a sense of a higher purpose than mere material gain. They under-gird the dignity of the individual and the mutual respect so necessary for civilized discourse. Promotion of these values is part of promoting a culture of humanism, a culture of peace.

Indeed, each human being has to have individual freedom and group identity. A properly functioning system of values in our educational systems will ensure that this group identity is not at the expense of the bond of common humanity, and that respect for human life does not stop at some political boundary. Universal values are an essential part of the society we are all creating at the start of the new millennium. This requires balance. Balance between the emancipation of the individual and the harmony of the community, between the celebration of diversity and the recognition of our common humanity. Only thus will we be able to promote peace and have a truly dynamic democratic system built on equity and justice.

## CONCLUSIONS

Ladies and gentlemen,

Forgive me for having spoken so long, but as you can see, these are topics that I feel strongly about, and that today, in my part of the world, have literally become matter of life and death, on a daily basis.

And so, to our youth I say: You have been called the children of the internet, or the Facebook generation, but you are more. You are the vanguard of the great global revolution of the 21st century. So, embrace the values of science, and go forth into the journey of your lives, to create a better world for yourselves and for others. Think of the unborn, remember the forgotten, give hope to the forlorn, include the excluded, reach out to the unreached, and by your actions from this day onwards lay the foundation for better tomorrows.

To the distinguished group assembled here I say: Thank you. Thank you from the bottom of my heart for having come tonight.

To my friends in the Alexandria Trust I say: much of what we seek may seem to others like a dream, but we have learned that impossible dreams can be realized. So let us be bold, let us dream, and let us act accordingly.

Thank you.

# **TOMORROW'S UNIVERSITIES AND THE SEVEN PILLARS OF THE KNOWLEDGE REVOLUTION<sup>1</sup>**

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<sup>1</sup> A slightly different version of this material was initially presented at the International Association of Universities (IAU) meeting in Puerto Rico on 28 November 2012, and was subsequently edited and developed in 2013.





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## INTRODUCTION

We all agree that we are moving rapidly towards the knowledge based society and the technologically based economy, with the well-known and well-documented aspects of globalization overlaid on this transformation. Here I am speaking of the structure and presentation of knowledge and how we humans will most likely be interacting with knowledge, whether we are academics or researchers or simply the descendants of those who used to go to public libraries and ask the librarian for assistance with a good book to read or a reference source for the paper they are preparing for college. This knowledge revolution shall have profound implications for the institutions of education from kindergarten through post-doctoral levels, research, whether public or private, and the cultural institutions that support our knowledge structure such as libraries, archives and museums.

It is this that I refer to as the “New Knowledge Revolution”, a subject I have treated elsewhere

at length and in more technical detail<sup>12</sup>. This knowledge revolution can be diagnosed by seven key characteristics, which I like to call “pillars”, and which I shall briefly describe here. These are:

- Parsing, Life & Organization
- Image & Text
- Humans & Machines
- Complexity & Chaos
- Computation & Research
- Convergence & Transformation
- Pluri-Disciplinarity & Policy

Before proceeding to discuss the manner in which I think this revolution will impact specifically the universities of tomorrow, and making some recommendations as to how that inevitable transformation could be handled to smooth out the change and embrace the future, a brief word about each of these seven pillars is pertinent here.

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<sup>1</sup> See my earlier monograph: Ismail Serageldin, *The Shape of Tomorrow: The Seven Pillars of the Knowledge Revolution*, Bibliotheca Alexandrina, Alexandria, Egypt, 2010. That material was based on a distinguished lecture delivered by the author at the NSF in Washington in 2010.

## THE SEVEN PILLARS OF THE NEW KNOWLEDGE REVOLUTION

### **First: Parsing, Life & Organization**

Since the beginning of time, whether we were writing on scrolls or on codexes, whether the codexes were printed or in the form of manuscripts, the accumulation of knowledge was based on parsed structures, with units put next to each other like bricks in a wall of an emerging structure.

It was the juxtaposition of these individual parsed works that created the accumulation of knowledge... the rising edifice built piece by piece, brick by brick or stone by stone...

In addition each piece was “dead”. By that I mean that once published it stayed as it was until a second edition would appear. If we both had copies of the same book, we could both open to, say, page 157 and find exactly the same thing in our respective copies. It did not change whether we did it immediately after the book appeared or decades later.

The Internet changed all that...

The web page became the unit of parsing. Instead of the classical sequence of presentation, we now

think in terms of a home page and then hypertext links into other related documents. We can expect more fluidity into the merging of image, both still and video, and the transitions from one reference link into another.

Search engines complement the World Wide Web as the on-line material—unlike the traditionally published material – becomes alive. Today if I look up a web page, and you look it up, at the same location a few hours later, it will probably have changed, since the material is constantly being updated.

Furthermore, as we move beyond the current structures of the web, towards the semantic web, where we can search for relationships and concepts and not just objects, the structure of organization and presentation of knowledge will become one large interconnected vibrant living tissue of concepts, ideas and facts that is growing exponentially and which will require new modes of thinking to interact with it. It will automatically spawn these new modes of thinking and scholarship will no longer be parsed like bricks in a wall, it will be more like a smooth fluid flowing river.

If one were to try to take into account as well the emergence of the social linkages phenomena that the internet and the web have now made possible, we can now visualize what some specialists have called the “Meta-Web”, with high knowledge connectivity and high social connectivity. Does the Meta-web prefigure the connectivity of intelligence?

### **Second: Image & Text**

Throughout history, the primary means for the transmission of information has been text. Images were difficult to produce and to reproduce. This has changed. With the digital revolution, everybody can record images, both still and video, and computer generated graphics are becoming affordable by everybody.

The human brain can process visual information with incredible rapidity. Enormous detail can be captured and processed in a fraction of a second. So some new features of the current knowledge revolution appear imminent. One is the far larger reliance on image – in addition to text – in the communication of information and knowledge and the changing forms of the storage and retrieval devices that this will require as we move from text dependent book and journal to digital still and video

image presentations as well as three dimensional virtual reality and holographic presentations. Interactivity will also become a feature of this new image-based virtual-reality world. Again what does that mean in terms of the presentation, the search and retrieval functions and the interaction between the researcher and the material in the future?

And what does all this mean for the effective description in meta-data, the storage, searchability and retrievability of this enormous and growing world of still and moving images, both fixed and interactive? We will no longer be looking up images through key words entered into text data bases such as meta-data catalogues: Computers will do this for us.

### **Third: Humans & Machines**

With the exception of pure mathematics and some aspects of philosophy, it will no longer be possible for any human to search for, find and retrieve, and then manipulate knowledge in any field, much less add to it and communicate their own contribution, without the intermediation of machines. Even in literary criticism and the social sciences, the stock of material to search through can no longer be done manually.



This is not good or bad. It just is.

Now, after a special chess playing program called Big Blue of IBM defeated world champion Gary Kasparov in Chess in 1997, can we indeed ask, as some visionaries are doing, whether “consciousness” and “intelligence” are emanating qualities from very complex systems? According to some, we are going to witness that happening with machines when they will pass certain thresholds of complexity and power, such as when the level of the processing power reaches certain sizes, and software advances within a decade or so after that to certain levels, all of which is likely to happen within the first half of the 21<sup>st</sup> century.

But whatever the merits of that particular debate and its ramifications, it is clear that changes are already noticeable in the domain of libraries and the internet. One example of that is the new *World Digital Library*: The system allows one to link video, image text and commentary and maps into one seamless whole and to be able to search by many different approaches (time, geography, theme, cluster, or even by a single word) and browse the material as well as find what one wants from the

digitized material on offer from all the countries of the world.

#### **Fourth: Complexity And Chaos**

The world we live in is remarkably complex. The socio-economic transactions of a globalizing world are exceedingly intricate as, with the click of a mouse and the flight of an electron, billions of dollars move around the planet at the speed of light. The web of interconnected transactions is enormous, and the ripple effects of any single set of actions and its interaction with other effects is difficult to predict.

Our cities have become not only much larger but also much more complex, and ecosystems are not only delicate, they are intrinsically very intricate. So are biological systems.

The reality is complex and chaotic, meaning that complex systems have non-linear feedback loops that result in systems and subsystems that are extremely difficult to predict. Many of our models, based on the simple mathematics and analogies drawn from physics, are proving inadequate.

### **Fifth: Computation & Research**

Till now, Computing has been largely seen as the extension of a large calculating machine that can do dumb calculations at incredible speeds. Computer scientists and engineers were implementers who made the life of the creative people and the researchers less tedious. Wonderful tools, no doubt, but just tools all the same. Today, the concepts and the techniques of computing will become a central part of the new research paradigm. *Computational Science Concepts, tools and theorems will weave into the very fabric of science and scientific practice.*

Consider data management. Data when organized becomes information. Information when explained becomes knowledge. That in turn, when coupled with reflection, insight, and experience may lead to wisdom, but that is another story.

But beyond the scale and magnitude of the collections of data, we are looking for *connections between collections of data*. These pose particular problems that involve qualitatively different issues. Computer science is where the most work on such classes of problems has been done.

## **Sixth: Convergence & Transformation**

Domains are gradually converging. In simplest terms, once upon a time we had chemistry and biology as distinct and separate enterprises, now we have biochemistry. Such moments of convergence, generating new sciences and insights, turn out to be some of the most fecund moments in the evolution of our knowledge and the development of our technologies. Today we are witnessing the convergence of three hitherto-separate fields with the birth of BINT: Bio / Info / Nano Technology.

At the same time, we need to develop what the NSF calls “Transformative Research”. That is research capable of changing the paradigm in some fields and domains, such as synthetic biology and femto-chemistry. Such research is extremely valuable. Thus we witnessed the discovery of the structure and mechanism of DNA engender entire fields like genomics, proteomics and metabolomics.

A question before us, is whether such developments will remain serendipitous or will our research paradigm systematically force the development of such converging domains and transformative insights? I believe we are poised to do the latter.

### **Seventh: Pluri-Disciplinarity & Policy**

There is real value in crossing disciplines. Increasingly, both in academic organization and in tackling real-life problems, we note that the old “silos” of disciplines when functioning alone are counterproductive. Much of the most interesting work is being done in between the disciplines, where they intersect or where the gaps are.

Increasingly we recognize that our real life problems, such as poverty, gender or the environment, are all multi-dimensional and complex and require a special way of organizing all the various disciplinary inputs. Just as we say that diversity is enriching, so is the sharing of knowledge across disciplines.

The nature of the challenge, its scale and complexity, requires that many people have interactional expertise to improve their efficiency working across multiple disciplines as well as within the new interdisciplinary area.

### **Reinventing Education**

The structure of the institutions of education and learning, those that channel the preparation of future generations of humans and the trans-

generational passing-on of knowledge, will change. They will not only continue to evolve, they will morph into something unrecognizable to those who think of yesterday's schools as a model, or those who yearn for their collegiate university experience. The public and private laboratories and research institutes, those institutions that help in the production, assimilation and codification of current knowledge and the creation of new knowledge, will also change. However, here, I will just say a few words on the more obvious likely impacts of the seven pillars of the new knowledge revolution on schools and universities, barely touching on research facilities.

I think that we need to think even more boldly and dream of reinventing education completely...

The old model of rigid linear advance through 12 years of schooling, followed by four years of university after which one receives a degree that certifies entry into the labor force to practice some profession for forty years and then retire, will become totally obsolete. Continuous learning will be more than a slogan; it will be an economic necessity. The market will demand new skills, and an increasingly competitive world will force

enterprises to continuously upgrade the skills of their labor force.

Furthermore, the existing model of education, under the heading socialization, also tries to enforce certain qualities deemed important by future employers. Schools in fact teach children the discipline to endure boring and repetitive tasks that they get graded for mastering better and better. Their natural tendency to communicate with their peers, to run and play is curbed, by being told to “sit still and be quiet”. If they do not take easily to that regimen, they are now treated for Attention Deficit Disorder and even given drugs to assist them to comply. They have to stay hours listening to an authority figure, in a setting that is rarely a beautiful architectural space, on a chair and desk that are that are rarely particularly comfortable furniture. The student learns to be docile and to respect authority and to manage to do repetitive and boring tasks effectively. The implicit model is to train workers for boring repetitive tasks in factories or offices, something the industrial economy of the 20<sup>th</sup> century clearly demanded, despite its dehumanizing aspects so effectively portrayed by Charles Chaplin in “Modern Times”. However the globalized modern economy is

rapidly changing and robots are more likely to take over the more repetitive aspects of jobs in the future. We already see this clearly on the assembly lines of the automotive industry, being followed by industry after industry. Likewise, in offices tasks like data entry and checking are also increasingly being taken over by computers. The future will be for a lot more collaboration between humans and machines, and thus we must question all aspects of the educational enterprise that we have inherited from the last century. No matter how successful they have been, the policies of the past are rarely the best to confront the challenges of the future.

Education is likely to change profoundly in the coming decades, in terms of content, participants, methods, and organizational setting. Let us consider each of these in turn.



## ON CONTENT

Curricula and syllabi need to be revised to emphasize basic skills, problem solving and learning to learn. Teachers must be much better trained to become enablers who will encourage children to realize the joy of discovery, and be able to utilize teaching methods that allow each individual to change at their own pace.

The educational system of the future will witness an explosion in Content, beyond our capacity to imagine today. People will emerge from their basic education – increasingly including university level education – having learned to learn, and having acquired a basic infrastructure of fundamental skills, including interpersonal skills and the ability to function in a society. These fundamental skills will be complemented by a vast array of offerings in every conceivable combination of units and modules covering everything from artistic expression to advanced genomics, from music appreciation to mathematics. The flexibility of these combinations will allow people to learn continuously throughout their lives.

New fields of learning will come about. The most important discoveries will be at the intersection of the existing disciplines. Totally new fields have

come about, such as genomics and proteomics. And beyond the natural sciences we are discovering how important trans-disciplinary work is. We need the wisdom of the humanities in addition to the knowledge of the natural sciences. We need the insights of the social sciences to bear upon the technical options of engineering.

### ON THE PARTICIPANTS

Participants in our educational enterprise will still involve parents at home and teachers at school. But students will play a bigger role in their own development. And virtual communities on the Internet will create a new form of peer group affecting the mental and emotional growth of the children and young adolescents of the future. I say this, fully cognizant of both its upside and its downside. Perhaps we should be more open to what our children will have to tell us... Take the words of America's Poet Laureate, Robert Frost:

*Now I am old my teachers are the young.  
What can't be molded must be cracked and sprung.  
I strain at lessons fit to start a suture.  
I go to school to youth to learn the future.*  
-- Robert Frost

## ON METHODS

Methods of teaching in the last fifty years have been almost totally confined to formal instruction in classrooms. Lectures, tutorials and supervised work have been the staples of education from time immemorial. We have barely started to explore guided learning through such instruments as distance learning, the Open University and modular adult education classes. I say that noting that the open university has been around for more than four decades, and that Massive Open Online Courses (MOOCs) are now a reality through the experience of the Khan Academy (which has more than 3.9 registered students, and the presence of UDACITY, COURSERA, edX and other offerings. We are just beginning to see the benefits of flipped classroom instruction where the lectures are on video and done on the students' own time (which also allows students to replay certain parts as many times as they want) and the contact hours will be spent with the teacher working with the students, at problem solving and clarifications (the functions that were traditionally left to homework to be done by the student on their own time).

We have barely scratched the surface of the potential that exists in self-learning. New “games” or game-like approaches that allow youngsters to gradually master skills by solving ever harder problems will use the same self-encouragement mechanisms and inherent reward mechanisms that moving from level to level by shooting ever faster and killing more adversaries in current and conventional games do. The software advances and the private sector interest to develop such new educational software along with the possibilities of having tablet computers available in India under \$40 opens up enormous possibilities that will allow us to do much more in guided learning, and to help a thorough-going revolution in self-learning.

Although I believe that formal instruction will continue to be important, it will increasingly be supplemented by flipped classroom instruction, MOOCs, games and both guided learning and self-learning will be enhanced through myriad offerings. And it will not only benefit the youth in their school and college years. Driven by curiosity and self-interest, the lifelong learners of the future will alternate between broadening themselves or pursuing hobbies on the one hand, and acquiring

marketable skills on the other. The offerings for both will be there.

### **ON THE ORGANIZATIONAL SETTING**

The schools and universities will not be replaced by individuals working on computer terminals or on their mobile phones or other technologies, from home or from elsewhere. This is because they serve three functions: a skill and knowledge imparting function; a certification function; and a socialization function. The first and second will change along the lines I have just described. But the socialization function will remain.

Children need to be with other children of their age, and so do youth who are just reaching their maturity. They need to learn to interact and socialize with peers. Only schools and universities provide the requisite setting for such socialization, an essential feature of emotional development and the formation of effective citizens.

### **THE UNIVERSITY YESTERDAY AND TOMORROW**

The University is an essential institution in any society, for many reasons.

## The Mediator of Transition

It is the locus of the transition of adolescents into adults, and the incubator of effective citizens. It is the custodian of the great generational transition. The World Bank has identified five essential transitions that occur between the ages of 12-24 in most societies<sup>2</sup> and they make these years particularly important, and since the University helps mediate all these transitions, it is essential that it adapts the fashion in which it plays that role in the lives of our youth. These five transitions are:

*Continuing to Learn:* Whether to drop out of further structured instruction and university participation or not is the single most important decision in the teenager's life. Its repercussions and the future path of their career will be inevitably affected by it.

*Starting to Work:* The transition from a dependent student to an independent participant in the labor force occurs in these years, and traditionally with a pre-college or college education. The manner in which the university, and by extension the other institutions in the higher education system address

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<sup>2</sup> See World Bank, *Development and the Next Generation*, WDR 2007, Washington DC, 2007

that transition and facilitate it will have major impact on the economy and on society, not to mention the lives of the young people themselves.

*Developing a Healthful Lifestyle:* Key decisions on smoking, experimenting with drugs, attitudes towards sex and other choices that confront youth at that age can make all the difference in terms of their adoption of a healthy lifestyle or not.

*Beginning a Family:* Family formation starts at the older end of that age group. Thus the attitudes that they gain at university and the higher education system can make all the difference between a society with solid family units and one with broken homes. Household formation is about more than demographic change.

*Exercising citizenship:* The political awareness of the new generation is formed in those years, usually it is at university that they join political parties, start to vote and get exposed to a wide spectrum of ideas and debates. Their future attitudes as responsible participating citizens or detached apathetic individuals will make a major difference in effective democratic evolution of society<sup>3</sup>. The

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<sup>3</sup> See Robert Putnam et.al., *Making Democracy Work*, Princeton University Press, 1993.

attitudes they develop towards politics and society will also make the difference between the rise of extremism and the success of pluralistic politics.

The World Bank was concerned with government policies that will increase investments directly and cultivate an environment for young people and their families to invest in themselves in what they called “decisions concerning the five phases with the biggest long-term impact on how human capital is kept safe, developed, and deployed”. The World Bank then suggests that such policies should have three broad thrusts: expanding opportunities, enhancing capabilities, and providing second chances. Each pathway (opportunities, capabilities, and second chances) is applied to each of the five transitions, generating reform suggestions<sup>4</sup>:

Two of the traditional functions of the University have a major impact on the economy: Research and certification.

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<sup>4</sup> The World Bank then advocates that “To mobilize the economic and political resources to stimulate such reforms, countries must resolve three issues: better coordination and integration with national policy, stronger voice, and more evaluation”. Furthermore, the WDR 2007 also examines two other themes: youth migration, and the increasing use of new technologies. The former is not part of this essay; the latter is at the heart of it.



The search for truth in the context of *research*, and that increasingly involves partnerships with for-profit private sector entities in addition to the government financing of public goods research, with all the advantages and pitfalls that such an expanded partnership offers. The US Academies recently produced a report recommending ten specific actions that should be taken to maintain the pre-eminence of American research universities in the years to come<sup>5</sup>.

The other was the *certification* function. A university degree was assumed to certify that a graduate has acquired certain skills that an employer will want. Today, the lasting validity of that certification function is being challenged by the revolution in the knowledge society in ways that make it clear that the old model of 12 years of schooling, followed by four years of university and a degree that allows someone to practice a profession for 40 years and then retire is no longer valid. So what changes will be necessary?

First, the silos of disciplinarily in the traditional structure of instruction will have to change.

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<sup>5</sup> The National Research Council, *Research Universities and the Future of America*, The National Academies, Washington DC, 2012.

Convergence and transformation are making it clear that although we all need a foundation in one discipline to build on, we also need to learn to interact with others in others disciplines. Universities must adapt to that horizontal broadening.

Second, constant updating of knowledge and skills will be necessary, and a vast program of adult education will become an integral part of the University of the Future. It will allow for flexible career transitions and the modular upgrading of skills in different disciplines. Thus continuous education will become a necessity if labor productivity is to continue to increase.

### VALUES

Another traditional and essential function is the university's unique role as the *custodian of the past and the inventor of the new*, not just in terms of the socialization function and the societally approved behavior of citizenship, but in terms of values and culture. Cultural identity and the meaning and role of our heritage are part of it. History, archeology, cultural studies are all part of learning about our past and maintaining our heritage. But universities

are very much the palaces where the young learn to challenge the existing and the inherited, to seek novel answers and to invent the new. Thus it becomes the locus of challenging the status quo, and sows the seeds of innovation, whose products and constructs will become the heritage of the future. That double process of preservation and renewal, of authentication and opening up to the foreign and the new, is one of the unique functions of the university, which will remain and will be expanded in the future.

The University also supports the formation and transmission of the values of science. These values include commitment to truth, to honoring each contributor, to promoting imagination and questioning, to challenging the existing paradigms, to valuing imagination, to remaining open to the contrarian view and to arbitrating disputes by evidence and rational thinking. These are profound societal values, not just necessary behaviors to have effective scientific research. These values are forged by teacher example and student practice.

But perhaps the most important value that a university can promote in its relationship to society is the value of *freedom of expression*. For that is the

fundamental first freedom necessary for the practice of other rights. By its practice other socio-political features will evolve. Accountability and pluralism require the contrarian view to be heard and the minority position to be respected. That is what freedom of expression is all about, and universities have been, and will remain, the defenders of these values against the tyranny of the majority and the tide of the conventional taste and opinion.

### **THE UNIVERSITY AS A PHYSICAL PRESENCE**

Despite the enormous impact of the ICT revolution on many aspects of the learning experience, I do not believe that the university as a physical location will simply disappear. I believe that the university is not only going to remain the central part of a changing higher education system, but also it is going to remain a physical presence in our communities and our cities, and that the campus will remain a locus of interaction, not just within the university community, but also between the university and society.

Evidence for that abounds. MIT put all its courses on line, but that did not result in the disappearance of applicants to obtain the MIT

learning experience. MIT remains a major center of research and learning not just in the USA but in the world. The Library of Alexandria and the University of Pittsburgh present the SuperCourse, with over 170,000 PowerPoint lectures, but that does not replace the need for a proper institutional set-up for learning and socialization. The role of the University as a physical presence should not be underestimated.

### UNIVERSITY GOVERNANCE

The juridical status of the university is not the decisive issue in ensuring its excellence. Examples are many: e.g. UC Berkeley and Harvard show how a public and a private establishment can both be outstanding institutions. But in all cases a certain set of features mark their governance, including the degree of autonomy they enjoy in their decisions, the clarity of their sense of mission, and the standards they aspire to achieve.

Today, along with the general ideological drift in many parts of the world, there is a conception of idolizing the private sector, which suggests to some that higher education needs to develop a “business model” to curtail the increase in costs and promote

efficiencies. Some even go as far as suggesting copying the manufacturing Business Model with: Future employers as customers; Students skills as products; Teachers as workers; and the Administration as managers. Nothing could be more destructive of the educational enterprise as to think along those lines.

While the educational enterprise can certainly benefit from a radical overhaul in how it undertakes its duties, it is in the context of greater sharing with the students, greater involvement with parents and society, greater common exploration of the boundaries of the new, greater involvement of the social actors in this central societal enterprise that we must seek the business model for the 21<sup>st</sup> century. A decision-making structure in the university should include all the social actors as partners in this enterprise: Students, Faculty, Administration, Community, Parents, Government, Financiers, and Industry.

This would not only ensure a greater transparency, responsibility and accountability, it would also help resolve the old town/gown debate, as well as structure the involvement of the social actors in such a way that the essential autonomy of

the institution is protected by embedding it in the context of this broadened partnership.

So, let me now try to summarize and bring together these various threads into ten recommendations that I would make for the University of Tomorrow.

## **TEN ASPECTS OF HIGHER EDUCATION IN THE 21<sup>ST</sup> CENTURY**

### **1. Part of a Renewed Education System: Reinventing Education**

The ICT revolution and the transformation of knowledge manifested in the seven pillars are changing the concept and practice of education at this very moment, whether the authorities recognize it or not. Instruction is increasingly supplemented by guided learning and self-learning. The internet is opening undreamed of vistas of possibilities. On-Line education is a reality, and is growing fast.

On-line education can also leverage the “flipped classroom” technique used by a few innovative educators. The idea is to record the lectures separately, allow the students to see them on their own time, and maintain the classroom “face time” for the teachers and the students to work together

on problem solving and other tasks. This “flips” the conventional approach where the classroom face time is used for lectures and the students do the exercises and problem solving on their own.

These and other innovations are still in the experimental stage, in the sense that we do not know if they will bring improvements in learning and retention or acquisition of problem solving skills and imagination by the students better than other more conventional teaching techniques. In the 1960s in the US there seemed to be a concept that different meant innovation which was by definition better than the existing. Experience has shown that not all innovations are improvements and not all old-fashioned techniques need to be discarded. This will be equally true of the new and dramatic change that the ICT revolution is bringing to education.

## **2. A Changed Higher Education Landscape**

The ICT revolution is already offering many more options than anyone would have thought possible. Thus Khan Academy (<http://www.khanacademy.org/>) offers all sorts of courses in all subjects with on-line tutorials and other toolkits and support systems for both teachers and learners. The University of



the People (<http://www.uopeople.org>), is a tuition free on-line university intended to democratize Higher education. The Library of Alexandria in collaboration with the University of Pittsburgh, offers the Science Supercourse (<http://ssc.bibalex.org/>), a collection of over 170,000 PowerPoint lectures that can be used as is, or from which individual slides can be taken to compose your own lecture, and there are many other examples, with more being created every day. Another initiative, by The Jack Parker Corp. and Big Think, called “The Floating University”, aims to offer online Ivy League courses a la carte for a relatively cheap cost... and there are many other examples.

Indeed the challenges to the classical model multiply every day. Thus, when Stanford University professor Sebastian Thrun first offered a free online version of his “Introduction to Artificial Intelligence” class, 160,000 students from around the world signed up. Impressed by that and inspired by the Khan Academy, he created a startup, called Udacity, to pursue that model<sup>6</sup>.

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<sup>6</sup> See, “Professor leaving Stanford for online education startup” by Jeremy Hsu in *Innovation News Daily*, updated 1/25/2012 6:33:58 PM ET, (see [http://www.msnbc.msn.com/id/46138856/ns/technology\\_and\\_science-innovation/t/professor-leaving-stanford-online-education-startup/](http://www.msnbc.msn.com/id/46138856/ns/technology_and_science-innovation/t/professor-leaving-stanford-online-education-startup/)).

He is not alone. Others have moved into the area of Massive On-Line Open Courses (MOOCs). Two other Stanford professors have started a new start-up called Coursera that has been joined by a number of major research universities, with the purpose of offering MOOCs. No one doubts that what we see today, whether MOOCs or other forms of novel instruction will “morph”, and be transformed beyond recognition before they become mainstreamed into a new educational landscape. But no one doubts that their appearance heralds the beginning of a new era in higher education, whose matured manifestation will come many years hence.

Different from MOOCs but still relevant is a number of educational tools that are being developed in other ways in other places. Among these is the SuperCourse being maintained by the Bibliotheca Alexandrina (BA) and the University of Pittsburgh, that offers more than 170,000 PowerPoint lectures for free and which is being used by over 60,000 teachers in 170 countries to reach some one million students a year.

More interesting is the new concept developed by Egyptian Born entrepreneur Salah Khalil which

is being pursued by a start-up based in London called Macat. The idea there is to define the 400 seminal texts in each of 14 disciplines (5,600 books in total) and produce for each book a series of content specific critiques and enhancements that are offered in various modules and methods: including video and audio. The material involves an in depth understanding the context, origins and influences of seminal book through a series of modules. All that material relies on the best teachers from the best universities.

It is not clear whether all this will impact on the for-profit on-line universities and training programs and/or will impact the enrolments at the universities at which these professors learned and are or were teaching until recently. It is clear however, that the overall landscape of higher education is changing dramatically, even if the university, albeit a much transformed university, will remain a central player in that system in all societies.

Thus we can say that the landscape for higher education institutions is rapidly changing and is going to change even more dramatically. Pluralism of approaches and institutions is the new norm.

The old effort to fit universities into models and to strait-jacket the models with equivalences is likely to be further eroded by these new creations with every passing day. I say that fully realizing that various universities will want to consider equivalences for learning done elsewhere or not under their purview if they are to acknowledge these in some sort of credit to some sort of degree or certification. But too many of these will exist for each to be recognized, and many of these options will survive whatever the old-line existing universities think of them.

Yet, none of these will actually replace the university as a physical institution, where things important to society are undertaken. They will be seen as complements to the transformed university, which will have many manifestations.

### **3. The University and Society**

The University will be the locus of change in society. It is where the young learn to be adults, and where dependents become independent and active citizens. But it will be more. With continuing education becoming a must, I expect that the University of Tomorrow will have a large presence

of ongoing adult learning programs. This will mean that the traditional concept of the community of scholars will be supplemented by returning adults. This will help intergenerational communications as much as lateral communication. That and a major expansion of community outreach will be part of the University of Tomorrow, diminishing if not abolishing the old town/gown dichotomy.

#### **4. The University and the Economy**

We all know the dual role of the university: from preparing young people for the rapidly changing job market to driving research and innovation in a society. Both of these functions shall remain. But with the much greater blurring of the boundaries that I expect in the years ahead, it will be necessary for the University of Tomorrow not to lose sight of its fundamental functions and get attracted into the profit-making mode which is the rightful preserve of the private sector. Having cautioned against the wrong choice of business model, I also caution against turning away from the broader socio-cultural mission of the university towards the profitable and the excessive service of economic interests.

## 5. The Core Functions of the University

Many of the traditional functions of the university, such as the search for truth through research and dissemination and discussion, the defense of values, the mediation of transitions in young people's lives and the certification of having achieved a certain level of marketable skills, will remain. But the last, the certification function, will change dramatically in its content and in its manner of application as continuing education, and upgrading of these skills will become mandatory de-facto if not de-jure. Thus the university will not be just a stage in everyone's life, but a lasting presence in our community, our society.

As we learn to learn, and use a wide array of self-learning and guided learning in addition to more traditional instruction, and as traditional instruction itself changes, we must be aware of the possible risks associated with such a transformation. Our pursuit of personal choices could lead to dilettantism, and the pursuit of Pluri-Disciplinarity may produce a generation of generalists who lack the proper disciplinary foundations to keep driving the boundaries of knowledge and the machinery of the Science, technology and innovation (STI) triangle, so necessary for socio-economic well-being.

This balancing act will be the biggest challenge before the universities of tomorrow. Those who succeed will be able to retain or achieve that aura of excellence that is difficult to define precisely, but that great institutions of learning have always had.

## **6. Curricula for Tomorrow**

There will be multiple offerings on-line, not just at large but involving participants on campus as well. Such MOOCs and more specialized versions of it will also allow for “flipped classroom” instruction.

The content of the regular curriculum will probably be a three-tiered structure, with emphasis on streamlined but bedrock core programs, then lots of variation. The three tiers would cover:

- The foundation (a broad liberal arts and scientific exposure);
- The specialization in a discipline; and
- The trans-disciplinary exposure.

The teaching will teach above all “learning to learn” and an approach to knowledge and research, as specific content is likely to evolve rapidly. A firm and broad foundation in these attitudinal skills, learning skills, inter-personal skills, and

socialized behavior, as well as good grounding in one discipline and a broad exposure to the values of the university, will lead to graduation and the job market, but then followed by continuing life-long education, through formal instruction either on-line or in person, or a combination of both.

### **7. University Governance in the 21<sup>st</sup> century**

The University needs to involve as partners in its decision making the broad gamut of social actors with whom it must interact, and who are affected by and can affect, the institution's decisions. Thus it should involve:

Opening up the University to this broader set of partners will not demean it or diminish its commitment to excellence and the core values it stands for. Indeed, no less an authority than the late Stephen Jay Gould observed:

It is important that we, as working scientists, combat these myths of our profession as something superior and apart. ... science can only be harmed in the long run by its self-proclaimed separation as a priesthood guarding the sacred rite called the scientific method.(emphasis in original) Science



is accessible to all thinking people because it applies universal tools of intellect to its distinctive material<sup>7</sup>.

### **8. What Business Model for the Future?**

The attempt to copy the manufacturing business model into the university should be avoided. The business model it should adopt however is one where it can have a clear set of functions, and broad consensus by the social actors through its open governance structure, and seek to involve those whose decisions on funding will make the execution of these functions possible. That means the involvement of what are traditionally seen as external parties, but must become part of the University's business partners: The private sector, government and the civil society. The nature of the partnership is to have clear expectations and transparency in the use of the funds that each party has allocated to the university.

The fine-tuning of this business model will raise the question of the right balance between research and teaching, the role of the university as advisor to

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<sup>7</sup> S.J.Gould *Time's Arrow, Time's Cycle : Myth and Metaphor in the Discovery of Geological Time*, Harvard University Press, Cambridge, Mass.,1987, p.7

the government and the undertaking of programs simply because they are popular with the civil society. It will also raise questions about changing the profiles of the faculty. But that is where the governance structure comes in as a corrective to ensure that the university does not drift towards a profit-making business model at the expense of its educational and cultural mission.

### **9. Values and Modernization**

The University requires free enquiry for the practice of research and the pursuit of knowledge. That requires the adoption of certain values that I have referred to elsewhere as the “Values of Science”<sup>8</sup>. We all know that effective pursuit of science requires the protection of independence. Without independence of inquiry, there can be no true scientific research. The safeguards which independence requires are obvious: free inquiry, free thought, free speech, tolerance, and the willingness to arbitrate disputes on the basis of evidence. These are societal values worth defending, not just to promote the pursuit of science, but to have a better

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<sup>8</sup> See Ismail Serageldin, *Science: The Culture Of Living Change*, (second edition), Bibliotheca Alexandrina, Alexandria, Egypt, 2007.

and more humane society. A society that is capable of adapting to change and embracing the new. A tolerant society<sup>9</sup>.

Tolerance based on the adoption of the values of science is different from the tolerance begotten by indifference to the behavior of others, dismissing them without engaging them. Tolerance among scientists must be based on respect. Respect as a personal value implies, in any society, the public acknowledgments of justice and due honor. ... If these values did not exist the society of scientists would have had to invent them to make the practice of science possible. In societies where these values did not exist, science has had to create them.”<sup>10</sup>

All of these values are the core values of the university. They are values honed by teacher

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<sup>9</sup> See Barrington Moore, Jr., “Tolerance and the scientific Outlook” in Robert P. Wolff, B. Moore, Jr. And Herbert Marcuse, *A critique of Pure Tolerance*, Beacon Paperbacks, Boston, 1969, pp. 53-79. Regretfully, in the concluding paragraph, this excellent essay uses some unfortunate references to Muslims and the Koran, attributing to them the willingness to see ..“other books...may be cast on the flames.” This typically ignorant comment is a use of a Western stereotype that is unworthy of the rest of the essay, which deals with Science and tolerance and reason in the Western context.

<sup>10</sup> See J. Bronowski, *Science and Human Values*, (revised edition with a new dialogue, “The Abacus and the Rose”, 1965) Perennial Library edition, Harper and Row, New York, 1972, p.63

example and student practice. But broader still, are the functions that allow us to teach our children that words such as truth, goodness, beauty, equality, liberty and justice are not empty words, but ideas that civilized humans live by<sup>112</sup>. The university is the place where citizenship is first exercised, and it is where youth – and the returning older former students joining the adult education programs – can be exposed to the notions of civil discourse, dialogue and orderly debate of complex ideas in the framework of pluralism and mutual respect. That is a core function of the University of Tomorrow, especially in these times of rapid change and globalization.

### **10. Building in Change**

Whatever we do, and however much we reflect and plan, reality will overtake us with more change than we can anticipate. Thus it will be essential to build-in change into whatever plans we strive for. The mechanisms of constant and ongoing monitoring and evaluation of university performance and the changing socio-economic context in which it operates should feed back to the decision making machinery in the governance

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<sup>112</sup> See Mortimer Adler, *Six Great Ideas*, Macmillan, New York, 1981

model of the university. The ability to introduce change rapidly will be important. This will happen anyway in a pluralistic Higher Education sector as some of the institutions disappear and other, new and innovative, institutions appear.

### A GLOBAL UNIVERSITY?

While the internet has opened many avenues, and social media have become a part of everyone's life, it remains true that recent research finds that people who rely on Facebook for their socialization are less happy than those who actually have real world social interaction<sup>12</sup>.

It behooves us therefore to also raise the question about whether a global consortium of universities could join to offer at least some students a global university program, that would allow real experiential learning about real people and real social contexts. Here are some thoughts, defined in

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<sup>12</sup> See: "Facebook Use Predicts Declines in Subjective Well-Being in Young Adults" By Ethan Kross, Philippe Verduyn, Emre Demiralp, Jiyoung Park, David Seungjae Lee, Natalie Lin, Holly Shablack, John Jonides, Oscar Ybarra; a Research Article from *PLOS One* at <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0069841;jsessionid=7B9DB8A5009547B7A59D5D4B353A09E4> (Accessed 22 08 2013)

mid-2013, suggesting what such a program could look like.

### **A GLOBAL CONSORTIUM AND A GLOBAL PROGRAM**

The nature of the global society towards which we are moving at frightening speed, opens up new avenues for us to reflect on the possibilities that were barely feasible in the past. Already in Europe an acceptance of common standards and a systematic agreement between countries allows young people in the Erasmus Mundi program to take different semesters in different establishments in different countries as they work towards their degrees. This allows these young people to mix with youth of their age in different countries as they study with teachers of different nationalities and get exposed to the societies and cultures of various European countries. This undoubtedly broadens their perspectives, widens their networks of acquaintances and expands their horizons, regardless of the content of the courses they are formally studying.

We have long advocated as part of the Euro-Med schemes, that there would be an expansion of this Erasmus program to encourage youths from

both sides of the Mediterranean to have the benefit of this multiple exposure to different cultures and different peoples. Today, thinking boldly, there is no reason why the idea of such a program could not be adapted to a global scale. It could be built upon a foundation of MOOCs where membership in a class is no longer confined to those who are physically located near the professor and his or her base of teaching, it could be refined in the sense of having a consortium of participating universities that will agree to have such a program among their offerings, and make that option available to their students who participate in that program at the university, and a number of these students could then be the ones that physically go in different locations at different universities, and continue their studies in an expanded international framework. It takes the American “semester Abroad” concept and the European Erasmus program to a new scale and would open avenues for the brightest among the students of the developing countries to explore new avenues and become the first students who are truly trained and socialized as citizens of the world.

## CONCLUSIONS

Have we even begun to plumb the depth of the challenge and its implications? Can we even claim to have properly sketched out the full range of implications that the seven pillars of the new knowledge revolution will force upon us? Do we know what the technologies of the future will do to our ability to summon the spirit of the past and conjure inspiring images to help us create a new future? Who can tell?

I hope that the recommendations that I have sketched out will help lay the foundations for a proper response to a rapidly changing world, not by trying to define that world accurately and prescribe actions precisely, but by proposing approaches that will involve the key actors and allow for maximum flexibility as we allow the institutions to evolve and the processes to adapt and the boundaries to move as we respond to that ever changing landscape. As we increasingly move into a world whose wonders we can only dimly perceive. It would be hubris to imagine that we – who could never have imagined the impact of the internet 20 years ago, or the reach of Facebook and Twitter ten years ago – would be able to lay down a precise path to the future for the



next 20 years or so. We can only raise questions and express hopes...

Yes, there are no complete or even fully satisfying answers to many questions implicit in the discussions above. But in this modern age, we are “Questers”, to use the expression of Boorstin<sup>13</sup>, who understand that knowledge and cultural expression are a journey and not a destination, and who recognize that there is more importance in the fecundity of the questions than in the finality of the answers.

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<sup>13</sup> See Daniel J. Boorstin, *Cleopatra's nose: Essays on the Unexpected*, Vintage Books, New York, 1994, p. 17



## THE ALEXANDRIA TRUST AND MACAT INTERNATIONAL

The Alexandria Trust is a London-based charity dedicated to restoring world-class education in the Arab region. The Trust was founded in 2011 by Egyptian businessman and philanthropist Salah Khalil with support from a group of Arab business leaders who understand the vital role of education in advancing prosperity across the region. The Trust works by incubating strong projects capable of long-term sustainability and a lasting impact. It works in three critical areas: encouraging public debate about education and its role in society; expanding access for Arab learners to high-quality resources by translating seminal works into and from Arabic; and advising education ministries in implementing their priorities for improvement.

Salah is also founding director of Macat International Limited, a young company that is developing the world's largest interactive digital library and learning platform in the social sciences, arts, and humanities. Macat is dedicated to developing innovative, academically rigorous educational resources that unlock access to and enhance understanding of the world's most influential scholarship, for teachers and learners worldwide.

Macat provides core funding support for the Alexandria Trust, enabling 100% of other donations to reach their targets. While the two organizations are governed, led and operated independently of each other they share a commitment to catalytic philanthropy capable of supporting a step-change in education.





## ISMAIL SERAGELDIN

Ismail Serageldin is the Founding Director of The Bibliotheca Alexandrina (BA), the new Library of Alexandria, inaugurated in 2002. He also chairs the Boards of Directors for each of the BA's affiliated research institutes and museums. He serves as Chair or Member of a number of advisory committees for academic, research, scientific and international institutions and civil society efforts, including the Advisory Committee of the World Social Science Report for 2013, as well as the UNESCO-supported World Water Scenarios (2013-) and the executive council of the Encyclopedia of Life (2010-) and the ICANN Panel for the review of the Internet future (2013-) and Chairs the Executive Council of the World Digital Library (2010-). He also co-chaired the African Union's high level panel for Biotechnology (2006) and again for Science, Technology and Innovation (STI) in 2012-2013. Before that he notably co-chaired the Inter-Academy Panel on Capacity Building for Science in (2003-2004) and was a member of the High Level Group for the Alliance of Civilizations convened by the Secretary General of the United Nations (2006-2007). He has held many important international positions, including Vice President of the World Bank (1992-2000), and Chairman Consultative Group on International Agricultural Research (CGIAR, 1994-2000), founder and former chairman of the Global Water Partnership (GWP, 1996-2000) and the Consultative Group to Assist the Poorest (CGAP), a microfinance program (1995-2000) and was professor of the International Savoirs Contre Pauvreté (Knowledge Against Poverty) Chair, at Collège de France, Paris, and distinguished professor at Wageningen University in the Netherlands.

He is a member of many academies, including the US National Academy of Sciences (Public Welfare Medalist), the American Philosophical Society, the American Academy of Arts and Sciences, The World Academy of Sciences (TWAS), the World Academy of Arts and Sciences (WAAS), the European Academy of Sciences and Arts, the African Academy of Sciences, Institut d’Egypte (Egyptian Academy of Science), The Royal Belgian Academy, The Royal Society of Arts and Science in Gothenburg, Sweden, The Bangladesh Academy of Sciences, the Indian National Academy of Agricultural Sciences. He lectures widely, and has delivered the Mandela Lecture in Johannesburg (2011) and the Nexus Lecture in Tilburg, the Netherlands (2011) as well as the opening Keynote address to the first International summit of the Book at the Library of Congress in Washington DC (2012).

He has received the Order of the Rising Sun from Japan and the Legion d’Honneur from France and is a Commandeur of Arts and Letters of the French Republic. In 2013, Serageldin and the BA received the Calouste Gulbenkian International Prize for thoughts and actions that make a decisive contribution to, and have significant impact on understanding, defending and fostering the universal values of respect for diversity and difference, a culture of tolerance and the conservation of the environment. He has also received the Pablo Neruda Medal from Chile, India’s Bajaj Prize for upholding Gandhian values outside India, and was the first recipient of the Grameen Prize for lifelong efforts to fight poverty, and received the “Champion of Youth” award by the World Youth Congress in Canada.

Serageldin has published over 60 books and monographs and over 200 papers on a variety of topics including biotechnology, rural development, sustainability, and the value of science to society. He has hosted a cultural program on television in Egypt (over 130 episodes) and developed a TV Science series in Arabic and English. He holds a Bachelor of Science degree in engineering from Cairo University and a Master’s degree and a PhD from Harvard University and has received over 30 honorary doctorates.



