Calm Technologies: A New Trend for Educational Technologies

By Alexandru Tugui

Abstract

Over the last 50 years, technological development has been significantly influenced by computers and associated technologies. The massive investments made in information technology and communication development have benefitted all the world's economies, and especially the interconnected ones. All business areas have therefore adopted computers as an indispensable tool, and all economic and social processes have come to rely on computers for support and intermediation.

The education field has been, and will continue to be, receptive to the evolutions of information- and communications-related technologies. Educators will use them on a wide scale in projects such as e-books, e-learning, university networks, and digital libraries. Technological miniaturization and steady improvements in performance have resulted in the abandonment of classical technologies (white chalk, blackboard, paper, pencil, etc.) and their extensive replacement by PC tablet, video projectors, intelligent boards, e-pen, and other new applications.

According to various authors, deculturalization is one megatrend predictable for the long-term future of human society. Information technologies and communication will become increasingly omnipresent and will progressively acquire calm technology characteristics. The purpose of this paper is to focus on the contribution that these new educational technologies may have on deculturalization, and on the role of calm technologies in education.

Introduction: New Economy and the Increasing Lack of Culture of Human Society

The information society, knowledge-based society, and the new knowledge-based economy are three concepts that have been discussed in specialized literature for a long time. We define the information society as a society based on information, the society based on knowledge as a society based on filtered information, and the new economy as an economy in which both information and knowledge are production factors for the purpose of increasing national wealth.

In the modern sense, we may date the knowledge-based society from the first use of computers in economic activity, which began with the building of ENIAC in 1947. John Naisbitt places the beginning of the information-based society in the mid-1950s, when the number of white-collar workers in the United States first exceeded that of blue-collar workers.

It is no news that nowadays the computer is omnipresent, in all fields of activity. More than 60% of the gross domestic product of the United States, Great Britain, and Japan, and some other countries are generated by the efforts of over half of each country's active population working di-

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rectly or indirectly in the creation, storage, and transmission of information and knowledge.

Thus, people's initial fears of unemployment as a result of the expansion of information technology have been largely eliminated, as Emmanuel Josserand and co-authors argued in their 2004 book *The Network Organization: The Experience of Leading French Multinationals*. Josserand et al note that millions of persons today are employed in infotech-related fields and are earning good wages.

Mihai Drăgănescu, professor of information science and philosophy at the Polytechnic University of Bucharest, wrote in a 2003 thesis that the knowledge-based society involves a new economy in which the innovation process becomes instrumental. Such a society is based on the existing management of knowledge, on the production of new technological knowledge, and on knowledge spreading via electronic means (Internet, e-books, e-learning, etc.). This new economy will be more and more based on communication, which presupposes information as a production factor, and the recognition and extension of virtual goods (assets).

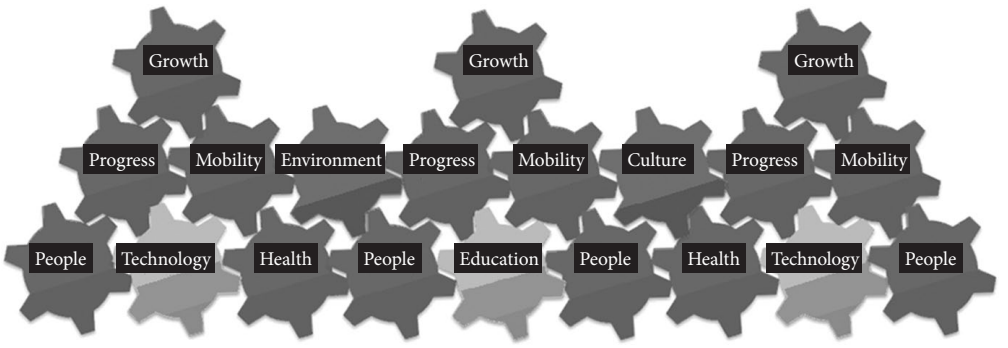
After a thorough analysis of the past ten years, Edward Cornish, in his work *Futuring: The Exploration of the Future*, mentions that human evolution has been shaped by three major technological evolutions, namely: the agricultural revolution, the industrial revolution and the cybernetic revolution. Much specialized literature has been written concerning the first two revolutions.

What may be of interest from the perspective of Cornish's analysis is the discussion on the computer-centered cybernetic revolution as main technological catalyst and data and information handler. Thus, the presence of the new economy was felt as early as the 1970s, when economic entities invested heavily in the automation of the main information flows.

In time, this process extended to most organizations, becoming the foundation of the future global information society. Cornish expects six super-trends to mark the future: technological progress, economic growth, improvement of people's health, increase of mobility, decline of the environment, and increasing deculturalization.

These six super-trends will manifest themselves in the new economy, where the process of digitization will become predominant and the computer will remain omnipresent. Based on a

Figure 1. "Socio-Technological Snake" and the Six Super-Trends Supported by Mankind, Education, and Technology.



quick analysis, it appears that the first four super-trends are favorable to the evolution of mankind, whereas the last two constitute major disadvantages and involve significant costs for humankind.

We insist upon the idea that one of the common points of the six super trends is education, the fundamental training of the people creating the technologies that generate increased mobility and economic growth with direct implications for the improvement of human health, and the danger of environmental decline and deculturation. In other words, education will be the key "advantage" of civilization, capable of influencing the quality of the developed technologies, the type and structure of economic growth, with direct effects on mobility, economic growth, and health, as well as on the decline of the environment and social lack of culture (see the "socio-technological" snake in Figure 1).

The key to success is limiting the costs of the two negative super trends in relation to the decline of the environment and the worsening of lack of culture, through a greater orientation towards the so-called calm technologies. For this to occur we must take into consideration a type of education that promotes and makes use of calm technologies.

Some Ideas about Calm Technologies

The concept of calm technologies was introduced by Mark Weiser of Xerox PARC in 1991 in his article "The Computer for the 21st Century." In 1995, Weiser and Seely Brown worked together to elaborate an article on the same topic, "Designing Calm Technology," which was then republished, in 1977 under the name "The Coming Age of Calm Technology," in the book *Beyond Calculation: The Next Fifty Years of Computing*.

Subsequently, this concept was taken over and analyzed by specialists in the field, especially as extended use of multimedia technologies and of the Internet came increasingly to be based on the idea that computers should disappear into the background of our architectural space and easily switch between the centre and the periphery of our attention as ambient displays.

One popular definition of calm technologies presents them as aiming to reduce the excitement of information overload by permitting users to select what information is at the centre of their attention and what information is peripheral.

In order to meet this requirement, they must possess three main characteristics: to be everywhere, to be small, and to be aware. "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it," Weiser wrote.

The evolution of calm technologies is described by some researchers as the disappearance of computers. The disappearance is physical, in that computers become small enough to be invisibly embedded in all kinds of devices. It is also a mental disappearance, in that humans do not perceive the devices as computers but as embedded elements of augmented artifacts in the environment.

Calm technologies shift the focus of our attention to the periphery—either by smoothly and easily shifting from the center to the periphery and back, or by transferring more details to the periphery. An example is a video conference that, compared to a telephone conference, enables us to perceive nuances of body posture and facial expression that would otherwise be inaccessible.

A technology is calm when it increases peripheral perceptions with direct implications for our knowledge, increasing our abilities to act adequately in various circumstances without being overburdened with information. Thus, the use of calm technology develops a pleasant environment.

Technological connectivity makes possible quick anchoring in certain circumstances despite a rapid shift from the center to the periphery of our attention. This permits broad perception of

the past, present and future of a subject—a characteristic that Weiser and Brown call "locatedness."

The main purpose of this level of technological evolution is that our homes, our possessions, and when possible the environment itself should be aware of—and capable of adapting and responding to—our varying comfort needs, individual moods, and information requirements. For example, we would only have to walk into a room, make a gesture or speak aloud and the environment would respond or react as deemed appropriate—turning lights on or off, adjusting temperature, etc.

Educational Technologies in the Virtual Economy

Technological evolution decisively marked the economic and social condition of mankind in all history stages, a phenomenon emphasized during the last decades especially by achievements in the field of information and communication technologies. By technology we mean a practical (scientific) application with the purpose of achieving the targets for specific activities.

By educational technology, we mean those technologies that support education and the learning process itself. Using computer-assisted technologies in education has been possible since the early 1970s, when their cost became affordable in many areas of human activity.

The term "educational technology" includes both analog technologies, such as clay tablets, blackboard, chalk boards, books, photos, audio, writing and drawing tools, movies, classic tools of computation, etc., and digital ones, such as e-tablets, tablet-PC, e-books, e-recordings, video projectors, educational software, educational games, multimedia presentations, e-learning platforms, digital libraries etc.

Today computers have become basic tools employed in all sorts of human activities. Currently, there is a trend towards miniaturizing and expanding the use of technologies in all fields and activities, including education, to attain the level of omnipresence and invisibility that would meet the definition of calm technologies.

The years ahead will bring essential changes in our everyday life. Thus, the use of computers will be further extended due to an increase by almost 100 thousand times in current performance, until it rivals or exceeds that of the human brain.

At the same time, there will be a significant reduction in the size and shape of computer processor chips. The resulting growth of information and communication technologies, together with the discoveries of new materials, will make so-called cyberspace a reality. Against this background, the new economy will be mainly virtual, where virtual goods will be handled in cyberspace.

When we speak of virtual goods, we see that they have existed for a very long time. There is a story in which a tramp with little money in his pocket passed in front of a restaurant where tasty food that smelled great was being cooked. The cook saw him and ran after him asking money for having smelled the food without his permission. To settle the matter, they went to a judge who, after listening each of them, eventually renders the following judgment: he asks the tramp to flick a coin on the table and the cook to listen to the sound, after which he said to the cook: "You heard the sound of the money on the table. This means you were paid."

As you can see, this story is about intangible goods, also called virtual goods. Real-life transactions involving intangible goods date back to ancient times as well. For instance there was the practice of army leaders' paying for information from fortune-tellers on the eve of battle.

In a sense, paper currency not backed by actual reserves of gold or silver counts as "intangible" or "virtual." Thus we can speak of a partially virtual economy already, because such money is often the medium used in international exchanges

and exchanges between individuals within an economy.

We more frequently speak of a virtual economy when a considerable part of the goods being exchanged becomes virtual, whether or not payment is rendered in virtual/account money. Moreover, in such a virtual economy information and its refinement become production factors recognized by the society, and computers and other information processing devices provide the principle production tools used.

It is most important to emphasize that in coming years the technological context of human society's evolution will be framed by the following trends:

1. Mobility.
2. Wireless networks.
3. Interoperability.
4. Digitization.
5. Multimedia.
6. Information integration.
7. Standardization.
8. Real-time work.
9. Artificial intelligence.
10. Communication 3G+, 4G.

At both macroeconomic and microeconomic levels the following concrete aspects of the true virtual economy may be highlighted:

- The positive impact of Infotech and Communications (IT&C) on economic growth by the use of new information and communication technologies in the GDP.
- The multiplying effect in the network generated by the capital invested in IT&C, the immediate effect of which will be to increase innovation and reduce costs.
- Information and communication technologies becoming omnipresent in both visible and invisible forms in all the walks of life.
- The contribution of IT&C to maintaining the balance in all markets: the financial-monetary one, and the products and labor market.
- Organizational redesign and reorganization, in order to achieve agile, virtual, and intelligent entities.
- The easy development of enterprise networks and network enterprises.
- Changing the managerial mentality regarding training and performance.
- Diminishing social gaps between members of society and changes in life style (affecting work, games, parties, etc.).
- Increased social isolation of individuals accompanied by the loss of individuality and intimacy (as buyer/user, etc.).
- Manifestations specific to the global village and to civil society, such as the introduction of electronic polls, electronic governance, and so on.
- The "Millennial Generation"—i.e., people boom between 1982 and 1998—replacing the Silent, Baby Boom, and Baby Bust generations.

During the next 20 to 25 years, human society will likely be dominated by a digital economy subject to the following trends assessed by experts at the World Future Society:

1. The race for genetic enhancements will be what the Space Race was in the twentieth Century.
2. Water will become the new Oil.
3. WiMAX networks will create countrywide Wireless Internet Access WiMAX (Worldwide Interoperability for Microwave Access).
4. By 2025, the average life-span will increase by one year every year.
5. Bioviolence will become a major threat.
6. Invention will become increasingly automated.
7. Japan will dominate development of personal robots.
8. Holographic 3-D TV will be a reality.
9. The Singularity, the "Holy Grail" of computing, will be achieved.
10. Electric cars will become fully practical by 2020.
11. Religion will grow in China while secu-

larism expands in the Middle East.

12. New technology will allow oil to be recovered from old wells.

13. Algae's huge potential as a biofuel will be acknowledged.

14. Nanotechnology may drastically decrease the value of diamonds and other traditionally rare and precious materials.

15. The Millennial Generation will have major impacts on society.

16. Quantum computers will revolutionize information processing by 2021.

17. Breakthroughs will double solar energy output.

18. Consumers will take active roles in inventing new products and services.

19. Virtual education will enter the mainstream by 2015.

20. Genetic research may conquer most inherited diseases.

As the *Journal of Virtual Worlds Research* pointed out last year, only around 100 million people participated in the virtual world in 2009, but the money spent on virtual goods accounted for several billions of dollars.

The special attractiveness of the virtual environment is sustained by over 300 million teenagers under 20, who are already very active in the virtual world on social sites and will shortly become adults experienced in advanced uses of IT&C. They are certain to recognize that the virtual environment is ideal for simulation, training, modeling, and knowledge acquisition for various projects in fields such as medicine, banks, investment, education, etc. Furthermore, a high percentage of governmental transactions will be made by electronic means as they are more cost-effective in this way.

On the negative side, education will be directly and indirectly impacted by the trends toward super-engineering and superficial training that could lead to narrow over-specialization and deculturation. We consider this a significant danger, which can only be avoided by improving the sophistication and appropriate content of educational materials through better-planned computer support even as education virtualization expands. For an educated population is both more receptive to—and more dependent on—infotech and communication.

The level of virtualization available for use today is vast. Modular access to electronic handbooks presents a case in point. So do virtual worlds, Intel educational technologies, e-twinning, and Semantic Digital Libraries, among many other projects and innovations.

Modular Access to Electronic Handbooks

This project allows students greater access to electronic books such as texts and handbooks. It is named LoLaLi, short for "Logic and Language links." The project continues the idea of Frédérique-Anne Pacifique Harmsze, University of Amsterdam—Van der Waals-Zeeman Institute researcher, from her 2000 PhD thesis, in which she proposed a modular access and content finding method for use in scientific papers. The hierarchic organization of the project is WordNet-like, as illustrated in the model in Figure 2.

Virtual Worlds

Virtual worlds are online environments where multiple users can interact with one another or with the environment. Some are "immersive 3–D environments" and give users a great deal of freedom in terms of where they go and who they can interact with. Users participate in the world by controlling an avatar, or online persona.

An avatar allows a user to choose how much of their real self they wish to portray in the virtual world, potentially allowing them to take on an entirely new identity. Below are some examples of virtual worlds and their use in education:

- Mare Mare Research Centre: Mare Mare Research Centre is a must for teachers thinking

about using the virtual world called "Second Life" in their teaching <http://learningismessy.com/blog/?p=196>;

• Health Info Island: This is a good demonstration of how to use existing virtual worlds for educational purposes without having to build one yourself (http://slurl.com/secondlife/Health-info%20Island/76/174/21). [NOTE: A Slurl* is a url that directs you to a reference point inside "Second Life."]

• Virtual Hallucinations: This site demonstrates effects of mental illness during a variety of episodes. Virtual Hallucinations facility in SL, which is designed to education people about mental health issues.

• Book Island SL area: Dedicated to the book publishing industry. There are here 80 shops showcasing writers, authors, editors, printers, publishers, SL and RL books. (http://slurl.com/secondlife/Book%20island/125/153/36/).

• Sun Virtual Work Space: Only for use by Sun Employees, it is a prime example of creative use of virtual worlds for collaboration and remote project work. Collaboration and work projects conducted between workers in remote locations (http://research.sun.com/projects/mc/mpk20.html). You can view a a video demonstration at http://research.sun.com/projects/mc/video/MPK20-oct2007.mov.

Intel Technologies

The Intel Company research fields also support educational technologies. Topics include:

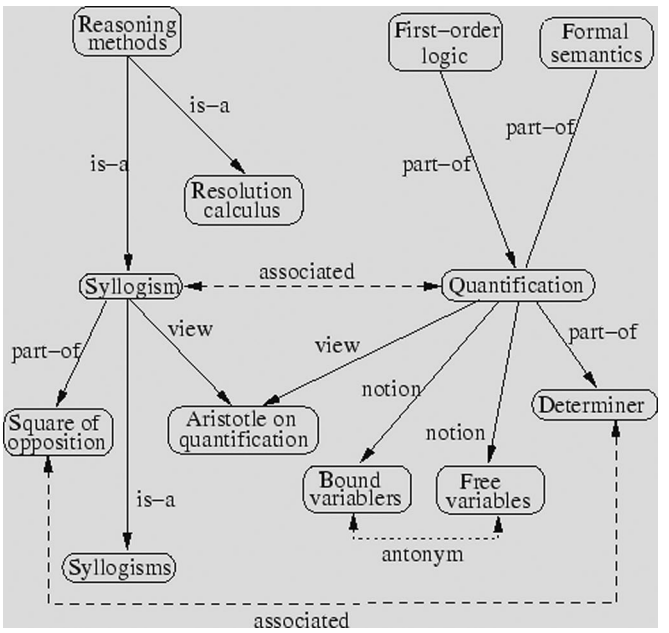
• BioComputing: The construction and use of computers which function like living organisms or contain biological components, so-called biocomputers.

• Cultural Anthropology: Fundamental paradigms and phenomena of everyday life to help Intel think critically about how people, practices, and institutions impact technological innovation and to conceive provocative experiences in the future.

• Mobility: Powerful, small mobile devices allow new ways to interact with the environment around them, and offer new ways for users to interact with and experience Internet-based data and services; thus, our daily personal entertainment and interactions with others and the environment will all soon be greatly enhanced.

• Networking: Intel engages in fundamental and applied research in all types of networks in-

Figure 2. Graphical Representation of a Fragment of the LoLa Hierarchy



cluding data, optical, wireless, and sensor networks.

- Photonics: The technology of moving data with light rather than electrical signals.
- Robotics: The Personal Robotics project at Intel aims to develop algorithms that enable robots to function in uncertain human environments. This project brings together the state of the art in perception, navigation and manipulation in one integrated platform. Application domains for our technology include home automation, telepresence, and eldercare.
- Sensing and Perception: The ability to perceive user context (e.g., location, activity and social interaction) is an essential ingredient of future mobile devices.
- Sustainability: Data collection, analysis, modeling, and 3-D simulation are just a few of the ways Intel technology is being used to help people solve challenging environmental problems.
- User Interface: The goal of user interface design is to make the user's interaction as simple and efficient as possible, in terms of accomplishing user goals—often called "user-centered design."
- Visual Computing: The use of computers to create rich visual experiences, primarily in 3-D.

eTwinning

eTwinning is a project launched in January 2005 aimed at facilitating partnerships, communication and cooperation among schools in member countries of the European Union, involving teachers and pupils in new learning activities: developing educational products that involve the use of new technologies and for the development of which they work with teams from other countries.

Semantic Digital Libraries: Exploiting Web2.0 and Semantic Services in Cultural Heritage

The Semantic Digital Libraries program is a service-oriented architecture that explicitly includes a semantic layer which provides services to the applications built on top of the digital library. The PIRATES framework helps end users to complete tasks concerning the retrieval of the most relevant content with respect to a description of their information needs (a search query, a user profile, etc.). Other projects of the Digital-Library type include Greenstone, D-Space, the Fedora project, the Archive Mapper for Archaeology project, and Cantabria's Cultural Heritage Ontology.

Other Influential Educational Technologies

To complete this review on the potential of information technologies used for educational purposes, we will add some information technologies that exist, which we believe will certainly influence educational technology in the medium to long term and which cannot be conceived nowadays without the support of digital technologies.

The first technology is the future computer that will take the form of a pen or small tool with projection capabilities. Its use in education will require training for potential users.

A long-awaited technology is iHolograms, which, combined with other future developments in interfaces, virtuality, object recognition and smart technologies, will change the whole concept of education in the next 10-15 years.

Conclusions

We are convinced that everyday life in cyberspace will involve technology that becomes constantly invisible and increasingly omnipresent. Our insights in the previous paragraphs lead us to conclude that human society will continue to evolve with the support of information and communication technologies.

We also anticipate that education using calm technologies can provide solutions to the problems posed by super-technologization and the risk

of deculturation. Such technology will remove barriers of language, time, and space between teachers and learners, and help to reduce today's huge costs for technical education, as well as facilitate the handling of large amounts of knowledge with efficient storage devices and the rapid access to visual and audio resources that offer well-documented, practical experience to students.

To the extent that these technologies meet the characteristics of calm technology, we anticipate that they will make a positive contribution to improving the state of the art in education and raising the level of cultural awareness generally. Principles like WYWWYWI (What You Want, When You Want It) used to support information technology education will promote subject mastery and improve the educational process.

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